REPRESENTATIVE ROSCOE G. BARTLETT

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PARTICIPANTS:

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Transcript by:
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REPRESENTATIVE ROSCOE G. BARTLETT (R-MD): Good morning and thank you all very much for coming. This is kind of like coming home to me. I worked here for 12 years at the community college, taught anatomy and physiology to the nursing students and also taught a biology course. And when the publishers saw that I taught a biology course, they all sent me their textbooks hoping that I would adopt it for the class of course and then they could sell some textbooks. And so over my desk went all of the textbooks in biology. And all of them had chapters on energy and environment and so forth. And I would read those. And so my concern about the subject that we're talking about today is more than 30 years old because I have been reading and thinking about this for at least 30 years now.

I really appreciate you all coming and especially appreciative of the members of the panels that have come. We have here today represented some of the experts from around the country and indeed around the world. I would just mention them briefly now – who they are – and then introduce them in more detail a little later.

Dr. Kenneth Deffeyes, professor. He worked with M. King Hubbert. Many of you may not know who M. King Hubbert is. I'm sure you will after today's session. You'll know who it is. And he will be talking to us about his concerns about the world's energy resources.

Matt Simmons is the president. I spoke with the president about energy and mentioned Matt. Oh, yes, I know Matt. Matt was his energy advisor during his first campaign and his second campaign. He is president and CEO. I guess you have relinquished one of those titles now so that he can spend more time to education of the largest energy investment banks in the world.

He has a new book out called "Twilight in the Desert" – intriguing title. And it's about Saudi Arabia and his concerns that Saudi Arabia probably has peaked in oil production. You may have noticed that when OPEC gets together and when the oil sheikhs come here they don't promise that they are going to pump a lot more oil to bring the price of oil and gas down. I think they are not promising because they can't produce more oil.

Richard Heinberg – and I'm really envious of him. He has taken the two best titles for books: "The Party is Over," is the title of one of his books. And the second title – really great title is "Power Down," because as you'll see in today's conference, that is exactly what we're going to have to do.

Then our second panel is going to do deal with what do we do about it? How do we transition so that we have a relatively soft landing? Donald Wulfinghoff – and he has written really a tall, an enormous book on energy conservation in buildings. He is perhaps the world's authority on energy conservation in buildings, which, by the way, is where we use our most energy. Most conspicuously we use energy in transportation, but we use most of it in our buildings and he'll talk about that.

John Spears – what does sustainability look like? How do we get there? And John Howe. John is a retired engineer in New England, and he has been pioneering this. He has written two books. And he has been giving these books away because he just is so concerned that Americans need to know about the energy crisis and what is coming.

I have a couple of slides to kind of give us started here. Okay, we need to go back six decades to kind of put this in context. During the '40s and '50s, and a scientist by the name of M. King Hubbert worked for the Shell Oil Company, and he noticed the exploitation of individual oil fields, and they all seemed to following a bell curve.

Now, most people know what a bell curve is. If you are noting the size of people – some of them are very short, some are very tall, but most of us is somewhere in the middle, and if you put all those down, you get a bell curve. And he noticed that the exploitation and exhaustion of these oil fields followed a bell curve. Then about halfway through it reached a peak and the second half of oil, logically, was more difficult to get than the first half.

The green there, the smooth green curve shows his prediction, and the more ragged curves shows the actual data points he predicted in 1956 that the United States would peak in 1970 and right on target the United States peaked in 1970, in spite of feverish drilling. I read the other day that maybe 80 percent of all of the oil wells drilled in the world have been drilled in this country. In spite of feverish drilling, it's been downhill ever since.

The red curve there is Russia – a bit more oil than we. And they picked a bit after us. And you see that they kind of fell off when the Soviet Union came apart. They are going to have a second much smaller peak because of the disarray that occurred there when the Soviet Union dissolved.

The next slide. The next slide is a schematic and this is a very interesting slide. The U-curve there or the parabolic curve there is the – the exponential curve, is a 2 percent growth, just 2 percent growth. From the beginning of the yellow to the end of the yellow is 35 years because that is the amount of time it takes with 2 percent compounded growth to double.

And what this shows is that if peak oil occurs at the point where it is shown there, that you start to have problems when the two curves diverge, because China increased their use of oil last year by about 15 percent. They increased their imports by 25 percent. And so for those who believe that peak oil is in the future -- probably. But we're now seeing the effects of it.

You know, there are three things that are not controversial. M. King Hubbert predicted that the United States would peak in 1970. We did. He predicted the world would peak about now and oil this morning was over $64 a barrel. So those are inescapable facts.

The next curve – the next chart. The next chart – this depicts the challenge that we have. And this is a little depiction of the Apollo 13. And they had started on their way to the moon, you noticed, and things collapsed, and they had to really make some changes if they were going to get back alive. This is a pretty good analogy. It's not that we're all going to die if we don't do the right things, and they all would have died if they didn't do the right things. But, boy, they had to do the right things at the right time or they weren't going to have a smooth landing. And there was a great movie made of that. I'm sure many of you have seen that movie.

Well, let's move now into our first presenter, Dr. Deffeyes. He had the privilege of working with M. King Hubbert. I hope he tells us something about that. He is author and Princeton University professor emeritus. He joined the Shell research lab where M. King Hubbert had recently issued his controversial predictions that U.S. oil production would peak during the '70s. It peaked at 1970, some people say '71, but about then.

After reworking Hubbert's numbers, Dr. Deffeyes sought other employment. He is the author of "Hubbert's Peak: The Impending World Oil Shortage," and his new book, "Beyond Oil: The View from Hubbert's Peak." He makes the case that world oil production is no longer increasing. Dr. Deffeyes.

(Applause.)

KENNETH DEFFEYES: This is a historic occasion in that a conservative congressman, an independent banker, and Ivy League democrat, and a radical social critic are telling you that we have arrived at the same answer. And it's – you better believe it – time. (Laughter.)

Now, if you want to make an author feel bad, this is a logo off of the coffee cup, my 40,000-word book reduced to a coffee cup – (laughter) – but it pretty well – it gives the message saying that it's wakeup time and we have to take this seriously. This is M. King Hubbert's original 1956 graph, except I have added the dots to show what happened. And the peak fit pretty well, and the 19 – wrong one – this shoulder is Prudhoe Bay kicking in – biggest oil field ever in the United States wasn't big enough to give us new high bigger than the 1970 peak.

Now, this could have staggered on upwards. And Matt Simmons' expression is you only see it in the rearview mirror. But one of the clues that I got at least was that the Texas Railroad Commission in 1972 removed production rationing in Texas. Before that, they were the OPEC of its day and regulated – excuse me – he would talk in Portland late last week. It was a nice audience of 300 people, one of whom had a bad cold. (Laughter.) I had brought it home.

But the bell-shaped curve worked out. And this is my most recent book. And the reason that I'm telling you about it is that I was able to – excuse me – to simplify Hubbert's mathematical derivation. And this is United States oil production. For the reason you just heard, it's the most explored area in the world. And after 1958, it settles down to a pretty good straight line. So with your permission, my computer and I draw the best-fitting straight line from 1958 on and once you let me draw that straight line, it's all over.

The three lines of high-school algebra up at the top are an alternative derivation of Hubbert's theory. And the only difference is he goes from A to B, and pages and pages of heavy deferential equations, and I go from B to A in three lines of high-school algebra. You get the same answer. The first equation is just the equation of a straight line. The second equation I plug in the things that are on the graph, P over Q is the vertical axis, and I go through and substitute what is on this actual graph. And on the third equation, I multiply both sides by Q. Now, that is the Hubbert theory.

And what it says is that the heavy magic is inside the parenthesis. What is inside the parenthesis is the fraction of oil that hasn't been produced yet. Or if you're doing exploration, it's the fraction of oil that hasn't been found yet. And the analogy is to fishing in a pond. If you notice after fishing several months in a pond, you're not catching as many fish, you can decide you'll go to the fishing tackle store and buy a fancy new fly rod – you know, new technology – or you can decide that you have caught most of the fish and you're going to go the grocery store and buy fish.

So the thing inside the parenthesis is the fraction of oil that hasn't been produced yet and what is not inside the parenthesis is the price of oil, which gripes economists – no end and new technology, which grips new technologists. And the answer is new technology and high oil prices help but they don't help very much. The big deal is how many fish are still left in the pond.

Now, this is Hubbert in 1968 predicting world oil production. And the 1968 curve, the more optimistic one peaks in the year 2000, and he has – 2000 – 100 billion barrels. Now, Hubert's critics say, well, 2000 came and went, you know. It didn't peak. Hubbert is wrong. But, look, for the standpoint of 1968, this is pretty good shooting to get to within five years of the year and to get to within about 3 percent of the total amount of oil.

Now, this is M. King Hubbert in the 1930s. He was no easier to get along with then than he was – (chuckles) – later in life. But it's interesting, I got a letter from a crystallographer long since retired who said I knew Hubbert at Columbia University in the 1930s. And he was interested in the problem even then. And looking back, I suspect that the first time – 1956, that the story was mature enough that he could see the answer he pounced.

Now, for the world – and we're getting to the core of the story here – after 1983, the world production settles down to a pretty good straight line, and there is one more black dot – because I had to release this to the publisher before the 2004 numbers came out – so the 2004 numbers – another black dot jammed between there and the plus mark. The plus mark is when half of the oil is being produced, and that third equation, a couple of slides back, had as one of its consequences that the peak of production occurs at the symmetry point when half of the oil has been produced.

And so I got an enlarged version of this and counted forward. And that is where I got to Thanksgiving Day this year, saying that that is my estimate of the peak. Now, I did that to make the economists nervous. It really is uncertain by about three weeks on either side. (Laughter.)

Now, this came across the Dow Jones newswire in 2003. And to me, it's almost an identical replica of the Texas Railroad Commission announcement that there would be no production rationing in Texas next month, and saying we don't have any surplus production capacity. And Matt Simmons' book confirms this view, but I took this as the first announcement that we knew – that I knew the world oil peak was real.

Now, this is the glubiest (ph) of the all of the diagrams, and it says that – sorry, these are attributing the oil to the first well in the field. When you drill a discovery well and you don't get oil, what do you do? Well, you keep drilling horizontally and vertically until you drill up the oil field. But it's an irreversible event. You don't get to discover that oil field a second time and you're not going to forget where your discovery well was. So this says that 90 percent – sorry, 96 percent of all of the oil we're ever going to find is in oil fields we have already discovered. And the – I don't have to extrapolate very far. That is where my 2013 billion barrels comes from is where that line hits the axis.

Now, the U.S. Geological Survey has an enormously more optimistic estimate. They have to find another Middle East plus another North Sea to come out even to fill in that gap between my estimate and theirs. Now, for the United States, they have estimated that there is another Kuwait undiscovered beneath the United States. Of course I tell them, hey, whisper in my ear where that sucker is. (Laughter.) I'll go have these with you. Is it South Alabama? So – because it doesn't exist.

But this is the gloom-and-doom picture. Now, when I put those same curves, the actual numbers and the best-fitting curves on a cumulative graph, the Bell-shape curve becomes and S-shaped curve. And the thing that is labeled exploration is the 6 percent that is not yet discovered. But the thing I have named after my friend Bob Snyder (sp) is now that the buzz word, "redevelopment" – going back and looking at old oil fields, existing oil fields – not for secondary recovery or tertiary recovery, but for overlooked productive oil sands. And in West Texas and the Gulf of Mexico, Bob Snyder found or bought some 60 oil fields and found several hundred million barrels of additional oil. And had an after-tax cash flow rate of return of 17 percent. So just a stunning performance.

And there are some companies doing that. And when I talk to financial firms, I tell them, if you find any company that is doing a good job of redevelopment, you know, call me collect; I want to invest in those. With the best rumor, if you're into financing, is that XTO, Cross Timbers Oil out of Forth Worth, is doing a good job. I haven't bought XTO yet. I'm looking into it. So this is the picture saying there is a considerable amount of the oil can be developed from existing fields. And it's not that it's not in the estimates. It's something that is going to happen.

Now, everyone asks about price. And here are natural gas prices in the United States. This is first sale of natural gas down the stream from the producing well. And the Henry Hubb's stock spot market prices look a lot like this only wilder. And the thing – it's very smooth up until about 1985. Then you start seeing little wintertime peaks, and then it just goes crazy. And the stock spot market price at Henry Hubb Louisiana – I think it was $17 the day before yesterday, the last time I looked. We are going into the winter with already high-midwinter prices. The current price is way off the top of this screen here.

Come on, baby. All right, now there is some essential services. (Laughter.) This is an ambulance that we want to make sure that we have got oil for. And we don't – you see the Red Cross on the side of the ambulance there. Here are industries that are going to get pretty hard. And the big ones are at the top of the alphabet. The zymurgy is just the industrial use of yeast to make wine and cheese and bread. (Laughter.)

But up at the top, agriculture is at great risk because the green revolution of 1970 that made starving to death no longer fashionable was based on new seed varieties, heavy use of mineral fertilizers, and pesticides. Now, the pesticides are mostly petrochemicals. And the mineral fertilizers, the nitrogen requires natural gas for the source of hydrogen to take nitrogen out of the atmosphere. And the phosphate is very energy intensive, converting rock phosphate to soluble superphosphate. So agriculture – excuse me – and particularly third-world agriculture is at risk.

Now, the automotive business – it isn't a matter of simply CAFE standards, raising the required mileage. One opportunity that I think is being missed – there are diesel automobiles. And if you look up on Google, common-rail diesels, you'll find that there are diesel automobiles in Europe that get more than 100 miles to the gallon. And we are not selling those things in the U.S. I wish we were and I don't know why not.

From the standpoint of aviation, everybody is going to get hit. And one of my predictions is those nice vegetables that get flown from the – and fruits – they come up from the southern hemisphere during our winter will get impossibly expensive, and we're going to have to learn to love rutabagas and parsnips and turnips – (laughter) – a bunch of things that I hate because they can be stored in root cellars in the region where they are grown.

So it is going to affect us. However, we have a family legend – my brother and I. After my first book came out, my brother read it and said, uh-oh, aviation is really in trouble. And he says, I know a vice president at Boeing. I'm going to send him a copy of the book. Well, forgot about it. Four years later, Boeing introduces the 7E7, now, the 787 with the lowest fuel cost per seat mile of any commercial airliner. And they are racking out sales and beating out Airbus for the first time in several years.

And my brother and I quietly agree – I went back to my brother and said, did you send the guy the book? He said, well, I'm not claiming credit, but I sent him the book and I said, you better read this, you better memorize this; this is your future. So my brother and I claim to have bailed out Boeing from this problem. (Laughter.)

Now, this is a reminder that there will be rationing. The economists all think it will be rationing by price and they'll raise the price until nobody can afford it any more and you do without. The next one – the next administration – fix the price of oil and thereby invent rationing by inconvenience. There were these long lines of cars waiting for what little gasoline there was in the filling station.

And the third one – during World War II, President Roosevelt had us running around with little red and blue ration coupons. So there will be rationing where there is going to be pressure on the government to do something and doing something might involve something other that just letting the price rise.

I found this in Taiwan. I don't read Chinese but I claim it should say, tell the kids to turn out the lights. There a lot of small-scale things that we can do. And your speakers – later you will hear about some of these, but changing our habits – multiple uses every time you take the car out of the garage, turning out the lights, energy conservation is certainly going to be a major part of what has to happen.

Now, people ask, well, how about some new technology? Well, this is an old technology. This is a guy delivering in the city of Paris in 1870 a mixture of hydrogen and carbon monoxide. Now, a more dangerous toxic mixture is hard to imagine. (Scattered laughter.) But it was used for cooking and it was used for lighting. And you can see a gas street lamp across the street.

Well, the modern version of this – Texaco engineers improved it with using pure oxygen, higher temperatures, better catalysts, and once you have got the hydrogen, you can do lots of things. The Chinese are making fertilizer, nitrogen fertilizers with the hydrogen. It's used in petroleum refining. The Canadian Tarzans – every time they break a carbon-carbon bond to lighten up that oil, they have to stick on two hydrogens. Where do they get the hydrogen? Natural gas.

So there are – there is a long list. But one of my colleagues is very enthusiastic about this one: dimethyl ether, which I had never heard of – and it's an almost perfect diesel fuel in that – excuse me – there are no carbon-carbon bonds in that molecule so it can't make soot. You can't get black smoke coming out of a dimethyl ether engine, is non-toxic. I didn't believe that. I had to go to the drug store. And the propellant in hairspray today is all dimethyl ether.

The old operating room anesthetic was diethyl ether. And it's made from coal. And there is a pilot plan in China turning out – I think it's in the 100,000-gallon-a-day department. They are selling it as a heating fuel, a cooking fuel to compete with butane and propane, but their ambition is to get the cost down under $2 a gallon and sell it as diesel fuel.

Okay, the hard landing, soft landing – of the soft landings, you need to get enough new nuclear capacity, energy-efficient automobiles, energy-efficient housing, wind energy in place by this coming Thanksgiving. (Laughter.) Well, you know, tough assignment. So what does a hard landing look like? What are we trying to avoid? And the simplest of hard landings is a global recession worse than 1930, worse than the Great Depression.

The extreme hard landing – I borrowed the four horsemen of the apocalypse. The pesticides, as I said, are all petrochemicals, that fertilizer is going to be expensive and difficult to transport, so that things could get pretty bad, and the – or story – Amos Nure at Stanford is all but predicting a war between the United States and China over access to world oil supplies. Now, he says, I don't want to see a war between the U.S. and China, and I hope that by predicting it, we can avoid it.

But back to the soft landing, the announced purpose of this meeting is to arrange for a soft landing. And this is my reading of your chances. My granddaughter Emma colored this and signed it. It's a snowball in hell. (Laughter.) Good luck.

(Applause.)

REP. BARTLETT: Thank you very much. Let me use just one little analogy to try to put the challenge we have in perspective. We in our country are very much like the young couple that just got married and learned that they had a big inheritance from their grandparents. So they have established a lifestyle where 85 percent of all of the money they spend comes from their grandparents' inheritance, and only 15 percent from their income. And the grandparents' inheritance is not going to last until they retire. So obviously they are going to have to do something. Either they are going to have to spend less money or they are going to have to make more money.

I use that 85-15 because that is exactly where we are in this country. Eighty-five percent of the energy we use comes from fossil fuels. That will wind down and by and by, we're going to have to live on that 15 percent and hopefully we can grow it above the 15 percent that it is now. But that is the dimensions of the challenge that we face.

Our next speaker is really world-renowned. He has just published a new book, which I think is going to be a best seller, "Twilight in the Desert." He has now relinquished on of his positions in his company so that he has more time to do what he is doing today and to help educate the American people. Matt Simmons.

(Applause.)

MATTHEW SIMMONS: Well, thank you. It's a pleasure to be here. It's been interesting in the last six months to – I've had some unbelievably interesting educational experiences as a result of coming out with this book and participating in – I guess this summer – 110 radio talk shows around North America. And I will tell you that people hearing bad news truthfully are willing to take bad news. It's been really remarkable. I've also had a really interesting experience getting acquainted with Congressman Bartlett and seeing how amazing it is that someone can pick so quickly up on these facts. I happen also to be slowly but surely co-authoring an ed-op piece with another congressman. He's been long retired – Stewart Udall. Fifty years ago, Stewart Udall was sworn in as a congressman of the United States, and then during the '60s, he was secretary of the interior in the Kennedy and Johnson administration. And our co-authored piece – if I can ever finish up my second draft and send it back to Stewart Udall – is "50 Years of Energy Mistakes" because he can go back with the benefit of hindsight and actually discuss 50 years, 25 sessions of Congress, how we made one mistake after another. So this is basically a big problem.

It was also interesting – last Tuesday morning, I was at the – in London at the Oil & Money Conference, which is probably the most important global sort of conference held once a year where all of the sort of senior OPEC people are there and all of the – a lot of the CEOs of major oil companies. And on the first panel of the morning, there were three of us – a lawyer, and then I was the first speaker, and the third speaker was Dr. Sadad Al-Husseini, who is retired executive vice president of Saudi Aramco in charge of oil and gas. I think the audience thought that they were going to witness a literal verbal battle because my views on the worry about Saudi Arabia's oil are now very public and Dr. Al-Husseini, who is a Ph.D. from Brown, was known as the brains of Saudi Aramco until he retired a year and a half ago. I surprised the audience by not really getting at all into Middle East oil. I basically said, we're all consumed now with the fact that we've run out of refinery capacity. What's even more profound is we've run out of drilling capacity. We're out of drilling rigs. We're just totally out of drilling rigs, and it'll take longer to actually restore capacity in drilling rigs than refineries.

And then Dr. Al-Husseini got up, and he – very politically correct because he wants to still live in Saudi Arabia – gave a very possible message through a lot of different slides. He effectively said that the Middle East has a productive capacity today of 21 (million) to 23 million barrels a day, somewhere in that range. And best case is by 2025 it will be 25 million barrels a day. Best case. And he showed basically the decline of Iran, and he showed the Burgan field and what would happen if it increased and then collapsed. He stayed totally away from his own country, but he speaking for his countrymen. And so it was a pretty astonishing speech.

What I was asked to address today is the topic of today's energy reality, and in my opinion it's a pretty simple story. We are in a deep hole. One of the interesting comments that I heard from an energy economist about four years ago was that the – he said, if you wake up one morning and you find out that you're in a deep hole, rule number one is stop digging. Well, our wakeup call is here because America and the world drifted into a benign energy war. How we drifted there was that demand was supposed to peak. It think it's so interesting. If you go back a decade ago and Google the word "peak," it was all demand is about to peak. It wasn't supply. Supply was supposed to grow and grow cheaply. Energy economist told other economists that didn't know anything about energy that told everyone else. And they said that one thing that's going to happen is technology is going to basically continually bring down the cost of extracting oil and gas – make it cheaper and cheaper and cheaper.

That belief was so deeply embedded that by 1999 when oil prices had suffered their biggest collapse in 50 years on a perceived oil glut that never showed up – it was just bad data – the best minds in the oil industry said, no, $10 oil won't last. It's going to go to five (dollars) and stay there for almost a decade because Saudi Arabia is going to flood the world with oil. And that became so believe that it became the cover story of The Economist. And then nine months later in their millennium issue, they published one of the funniest stories I've ever heard – "We Was Wrong" -- called it the biggest blooper of the 20th century.

Well, these were all great theses, but they were simply dreams. And now the alarm clock is ringing to wake up. These were just simply dreams. It turned out that everything went awry. Demand didn't peak; it grew too fast. 1995 – 10 years ago, demand finally exceeded 70 million barrels a day, but it took almost the entire year before people said, my gosh, demand is surprisingly growing again. Then over the next 10 years every time it grew, it was deemed to be an aberration. And the best guesses for the fourth quarter or the first quarter of the period we're going into is that global energy demand – oil demand – is apparently going to be between 87 (million) and 88 million barrels a day. That will be somewhere between 2 (million) and 5 million barrels a day more than we can supply.

And then in this era that costs were going to come down through technology, turned out a funny thing happened there. The cost to drill and complete an average well doubled. And we did find a lot of new supply over this period of time. It's just that they were all little things. I mean, Shell Oil Company now is talking about their expiration goal of finding some big cats. It was only a decade ago that the lingo was, we're going after elephants. And it turns out that all this technology we were talking about – it was sort of also illusory because we couldn't afford because of low prices to drill adequate appraisal wells and core the wells so we knew what was there. So we used the concept 3-D seismic, which has never ever shown anything about the -- anything about the possible structure, actually created reserves that weren't ever there. And so we systemically overstated our proven reserves. And then energy reserves that we had quite a bit of 10 or 15 years ago in this efficient free market were perceived to be glut. And so we used them up in the mantra of we're really getting efficient, and just in time supply has arrived with the energy patch.

And by August 2005, our spare capacity was disappearing. It was disappearing at the wellhead. It was disappearing in our system of pipeline and tankage to process to oil and natural gas so that it would become usable. It was disappearing in drilling rigs. It was disappearing in refineries. It was disappearing in people – people. We spent 20 years laying off about four times more people than we hired while the industry got more people intensive. Projects – there were no more projects to do either. We were effectively at 100 percent.

Somebody want to – well, now I need some help on it. We were at 100 percent capacity as we drifted into the end of August. And ironically, I spent the summer talking a lot about the fact that this sort of smells to me like the summer of 1939. In the summer of 1939, all of Europe was still in a daydream that we'll never have another war. And if you read the papers in the last week of August 1939, they were still daydreaming, we'll never have another war. And then on the 2nd of September we found out that we were already in the middle of World War II. It had started a couple years ago.

Well, in my opinion, Katrina was our energy 9/11. And ironically it happened on the 29th of August. What Katrina took away was more capacity than we had left in a nutshell. The full impact of Katrina is just barely beginning to be assessed. About the day before we had to evacuate the Gulf of Mexico again, they were just starting to do any inspection below the waterline. So all of the stuff – it didn't look that there was much damage – was also a dream. It might be that it didn't do much damage. The timeframe to rebuild is very hazy. All of these comments – well, this system is probably going to be out for two to three weeks – is basically just in the estimate that if we had everybody ready to go today and we knew what we should do and we were on a fast track, it would take two to three weeks. Natural gas got hit far worse than oil. And a local emergency from the Gulf will spin into a global issue.

If any of you didn't have a chance this morning to look at USA Today, there's a very interesting on page 4B showing the path of Rita. And what Rita did was finally sweep right over, while it was force five, the heart and soul of the platforms and pipelines of the Gulf of Mexico. And I think it will probably be Thursday or Friday before we have any sort of reports of the visual – how many platforms we don't have and what's happened to rigs. But it couldn't be good news.

So the question really becomes how did we dig ourselves into such a deep hole? Well, it was basically two decades of poor data. We had an energy data system that wasn't ever very good, and it got worse. It was basically then two decades of terrible analysis of bad data. It was basically the fact that all of our energy experts were basically the generals fighting the last war. These experts were still smarting over the fact that they got shrill in 1980 and '81 and predicted we were going to have $100 oil just as oil prices collapsed, as we had four years respite of demand growth as nuclear power came on. And they said, man alive, I've learned my lesson. Don't ever trust demand. And I'll tell you one thing, every time oil is high, we'll create a glut just like clockwork.

And low prices created by bad analysis and the perception that we had a glut created the wrong signals. Everyone was always saying prices are good signals. Well, we got actually the wrong signals from low prices. The low price signal said we'll always have low prices. And then turns out that strong opinions – really strong opinions by people who called themselves experts overruled facts. At this Oil & Money Conference last Wednesday morning, one of my favorite people in the energy business, Herman Franssen, who used to be chief economist at the IEA and is really respected among his peer group of chief economists, said to his profession – he said, I think basically, gentlemen, it's time to stop using the word I believe outside of church.

(Laughter.)

Well, what's our next step? Rule number one is stop digging. Rule number two is reform energy data. We urgently need a global mandated field by field production report on a quarterly basis accompanied by the number of wellheads that fields is producing so for the first time ever, analysts can do serious supply analysis. Rule number three is, let's go to an energy war footing just like we were forced to go to a war footing after Poland was invaded. And when we went to that war footing in five-and-a-half years from scratch, we created a war machine that was so powerful that we destroyed Europe and Japan. We can create a war machine and lick the energy war if we start today.

We also basically have another role model. In June 1947, we began the Marshall Plan. And in five years, the Marshall Plan – 2,500 people actually fanned out around Europe and created the blueprint and the foundation for rebuilding Europe. So it can be done, but not if we sit around. I basically believe there is a plan B that works, that it's going to work by basically addressing in the oil front – transportation energy has to be reduced. We have to move goods by trains and boats. Turns out the SUV isn't the problem. It's large trucks moving goods thousands of miles, getting three to five miles per gallon and clogging up our highways. Movement of people – we don't need 5,000 people to work in the same building on the mantra we need to communicate. And yet an exit poll says only 2 percent know each other. We have the technology today to work at home or in your village and keep your same job and be more efficient. We need to distribute food where we grow it, kind of victory gardens. Look at Whole Foods as a model. And they create a string of organic gardens with about a 30-mile radius of all their stores, and the food is good.

Natural gas problems, unfortunately, are really far more difficult to figure out how we fix. In fact, I don't know how we fix our natural gas problems. One thing we do is we stop using natural gas to create electricity, where we use up too much while we're creating electricity. And then R&D has to explode. For the first time in 100 years, we need to get serious about inventing some new forms of energy. Well, can the job get done? It has to. And ingenuity is the byproduct of panic. And I think what Katrina and Rita did, we will soon find out, was basically great panic. And I think probably unfortunately that was good news because we needed a wakeup call. The alternatives are too bad. And the longer we wait, the deeper the hole becomes. So stop digging. When should we start plan B? I actually say today would be a great time to start plan B. Thank you.

(Applause.)

REP. BARTLETT: Thank you very much. Matt Simmons used our response to the war in Europe as an analogy of what we need to do now. There are other analogies that may help us understand the challenge that we face. I think that the challenge we face is something like a combination of our decade of putting a man on the moon and the Manhattan Project. Unless we face this challenge with the kind of determination that we did those two challenges, we're going to have a pretty bumpy ride.

Richard Heinberg is a journalist, educator, editor, lecturer, and a core faculty member of the New College of California. He is the author of "The Party's Over: Oil, War and the Fate of Industrial Societies," and "Power Down: Options and Actions for a Post-Carbon World," to name a couple of his many works on the peak oil subject. He appears prominently in a documentary film, "The End of Suburbia," and has an award-winning newsletter and many articles to his name. Mr. Heinberg.

(Applause.)

RICHARD HEINBERG: Thank you. Well, I teach human ecology in a small private college so that informs my perspective on this subject. I see oil in terms of energy and human history. We're energy junkies, always have been, always will be. All organisms need energy in order to survive, and for all of our history as a species, we've been using our peculiar intelligence to try to find ways of harnessing more energy from our environment. We invented – we harnessed fire, first of all, then invented agriculture. We domesticated animals so that we could capture their muscle power by having them pull plows and so on. We invented water mills and windmills. But then, with the beginning of the industrial revolution, we discovered how to use – let's see, how do I get this thing to work. The slide is not advancing. Any suggestions?

(Laughter.)

Starting to use fossil fuels was like winning the energy lottery. There was nothing anywhere like it before. Think of it this way: suppose you had to push your car 20 miles. You can use levers, you can use pulleys, but you can't use electricity or any kind of fuel. That would be a fairly big job, right? Well, we get that service performed for us with a single gallon of gasoline, for which we pay a little less than $3 right now, and then we tend to complain about that.

The enormous benefits from fossil fuels were such that it was inevitable that we would become hooked on them and begin to design all of our social systems around them. This, of course, is the situation, as we have seen with the U.S., where discovery peaked in 1930. Forty years later, extraction peaked. So we learned the lesson about peak oil – what it is, how it works. It's no longer just a matter of projection into the future or reading tealeaves. We're talking mostly history here in fact. This is a well-studied scientific phenomenon, and it has real life consequences.

The U.S. used to be the world's foremost oil-producing nation. When I tell that to my 20-something college students, they look at me as though I must be crazy because they've lived their entire lives in a situation where the U.S. was by far the world's foremost importer. We import almost 60 percent of what we use now, but we used to be the world's foremost oil exporting nation. Seven out of every eight barrels of oil used by the Allies in World Wars I and II came from Texas and Oklahoma oil wells. We were loaning money to the rest of the world in those days. Now how things have changed. Of course we have become the world's foremost oil importer. China and Japan are number two and three in that regard, and the U.S. imports twice as much as China and Japan combined. And we've become the world's foremost debtor nation. We're borrowing about $2.5 billion per day just to finance our trade deficit, and about 40 percent of that borrowing goes to pay for oil.

So are all of these changes to our economy the result of U.S. peak oil? Not all of them. Certainly some of them could be wrapped up to bad management and other kinds of decisions, but a lot of the changes that we've seen in the U.S. over the last 50 years or so are simply the result of the gradual exhaustion of the energy resource phase that helped make this the wealthiest and most powerful nation in the history of the world. Now, as ExxonMobil has helpfully informed us, global oil discoveries peaked around 1963, '64. And they've been going downhill ever since. This little bit of optimistic news at the end there is really just some discoveries in central Asia and Kazakhstan. And since 2000, discoveries have continued to dwindle, and now they're about the level of the early 1920s. So there's not much more to expect from discovery.

This is a graph that's published by the Association for the Study of Peak Oil, Colin Campbell primarily, and it shows difference between conventional oil and non-conventional petroleum resources like natural gas liquids and tars and so on. As you can see, historically we've gotten most of our oil from, you know, the cheap easy stuff that flows out of the ground under pressure. And these non-conventional sources are becoming more and more important in spite of the fact that they're much more expensive and difficult to produce simply because the regular oil – regular conventional oil – is just about at peak right now. There's not much more to be had in that regard.

Now Chevron is beginning to take out ads in newspapers and magazines that have a nice website called willyoujoinus.com, again helpfully informing us that oil production is in decline in 33 of the 48 largest oil producing countries. In other words, it's not just the U.S. that's peaked. Country after country is doing the same thing. Indonesia, an extremely important oil exporter throughout the twentieth century, this year is importing more oil than it exports. So almost every year we see another country move from the column of oil exporters to the column of oil importers. Obviously that can't go on forever.

OPEC has informed us quietly that light sweet crude has peaked. Since the year 2000, of course, the amount produced on a yearly basis has continued to increase. But the amount of light sweet crude – the easiest stuff to refine into gasoline – has actually declined. So total oil production has been on the increase, but light sweet crude is actually declining. Saudi Arabia, of course, whenever we get into a jam always steps up and says that they will produce a little more oil. But what they're producing, of course, is the heavy, sour crude that no one really wants. And so it has to be discounted 10 (dollars) or $12 a barrel.

China – Chinese National Offshore Oil Corporation chief economist Xiang Wei Ping (ph) just this moth said he expects global oil production to peak at 94 (million) to 100 million barrels a day during the next five years. And here's a nice little quote. High oil prices will have adverse effects on China's economy said Xiang. Yes, I think so. That's a pretty safe statement.

Now this is an extraordinarily important report that, even though I didn't help author this report, I want to hammer on it for a few minutes because I think it's something that everyone should be talking about and virtually no one is. It was commissioned by the U.S. Department of Energy, paid for by the U.S. Department of Energy. Science Applications International Corporation compiled the report. Robert L. Hirsch was the project leader, and the title of it is "Peaking of World Oil Production Impacts Mitigation and Risk Management." Now U.S. DOE asked ASIC basically two questions: is global peak oil a real problem, and, if so, what should we do about it? Now this is the executive summary that they came up with, and I'll read it to you. The peaking of world oil production presents the U.S. and the world with an unprecedented risk management problem. As peaking is approached , liquid fuel prices and price volatility will increase dramatically, and without timely mitigation the economic, social, and political costs will be unprecedented. Viable mitigation options exist on both the supply and demand sides, but to have substantial impact, they must be initiated more than a decade in advance of peaking.

Now this report is extraordinary because, well among other reasons, economists have been telling us for some time that peaking of world oil production, even if we need to be thinking about it at all, is really a very small issue because as prices increase, they'll stimulate more exploration. They'll stimulate the production of alternative fuels, and they'll stimulate conservation. And with the combination of all three of those factors, we should make a very smooth and easy transition so that 25 or 50 years from now, we'll all be driving hydrogen cars down the street. No one will know that anything even happened. There won't even have been a bump on the road. We'll look back, and we'll say, what was that all about?

Well, the Hirsch report says that, in fact, those price signals will come at least 10 years too late and maybe 20 years too late to make a real difference. In other words, yes, we can make a transition, but it takes time to prepare that transition before the price signal arrives. For example, we all know we could be driving more fuel efficient cars right now as was mentioned. There are European cars that are already getting 100 miles to the gallon and more. Problem is it takes time to change over the U.S. car fleet. First of all, U.S. manufacturers have to retool and start making those much more highly efficient cars in large quantities. That will take probably four or five years. Then, not everyone buys a new car every year. I happen to drive a 25-year-old Mercedes diesel that I run on biodiesel, but that's not too uncommon. A lot of us drive cars that are 1-, 2-, 5-, 10-, 15-years-old. So that's going to take 15 to 20 years to change out the entire U.S. car and truck fleet. So we're looking at a process of transition there that will likely take 20 to 25 years.

It's the same wherever you look. To produce new supplies of energy from sources like biofuels, hydrogen, coal-to-liquids, gas-to-liquids, which of course is ridiculous anyway because we're running out of natural gas – all of these will take years to implement, to ramp up to any large scale. I was recently in South Africa speaking to the executives of Sasol Corporation, which has the world's most highly developed coal-to-liquids technology. South Africa also has lots of high quality coal, but in South Africa they're getting 150,000 barrels of synthetic oil per day from coal. Now that's good for South Africa, but that country is at the same time importing 450,000 barrels of crude oil per day from Saudi Arabia and Iran. So even in the country that has the most highly developed technology and good coal, they're still mostly importing oil. So to think that we could deploy that technology rapidly enough to fend off peak oil if we don't have a decade or two to prepare is really foolish.

Yes, there are differences among the experts as to when the peak is likely to arrive. Some of us are saying it's virtually here now, but there are other experts saying, well, maybe it'll be 20 years down the line. And the effective message from that more optimistic forecast is don't worry, be happy. Forget about it. We don't have to do anything. Certainly the government shouldn't have to do anything about this because the market will take care of it. But the Hirsch report gives us an entirely different message and one that we should be talking about. When I found out about the Hirsch report, I discovered it on a high school website – a high school in Chula Vista, CA. It has not, to my knowledge, yet been published on the Department of Energy's website or by any U.S. government agency. It's not being discussed by the administration. It's not being discussed in Congress except perhaps by Representative Bartlett. So we have a huge pattern of denial with regard to this problem. And even when a U.S. government report tells us about the problem, we choose to ignore that.

So as we've already seen, this is a problem that is going to impact the global economy profoundly. Ninety-seven percent of our transportation energy comes from liquid fuels, from petroleum. Food and agriculture – the miracle of agricultural production over the last several decades almost entirely dependent on fossil fuel inputs. And finally, our tendency as human beings to fight over scarce resources – we've had oil wars in the past already during the twentieth century. It's extremely likely that we'll have more in the years ahead unless we do something about this.

Now, we've already heard a bit about Katrina. I think it's important to think of Katrina also as a metaphor for how we are responding to the problem of peak oil. We could see Katrina coming from miles and days ahead. Everyone in New Orleans new that the city was vulnerable, and yet there was a shameful lack of preparation and response. The next disaster, peak oil – fully anticipated by the experts – everyone agrees, in fact, that global oil production will peak – only some disagreement about the timing. I think we're going to see a woeful lack of preparation unfortunately because the even is probably so close that we don't have that 20-year cushion that the Hirsch report says that we need. We need mitigation efforts ahead of time. And we, I think at this point, need to begin to create crisis management options – what we can do immediately to reduce demand primarily, but also to set into force alternative supply strategies.

As a result of these two hurricanes, I think our forecasts for peak oil may be shifting somewhat. At least mine are. I no longer anticipate seeing a clear and sharp peak where one day or one month or one year we can say production is on the increase and the next year or month, it's on the decline. There was the peak. I think we've been prematurely catapulted into a bumpy plateau period, which may last five years, maybe 10 years, during which we will see impacts to supply and demand from political and economic events and probably further natural disasters. And every time supply collapses, we'll be able to point to a particular approximate cause – a natural disaster or a political problem, a revolution in Nigeria or who knows. And we'll say, well, that's temporary. We'll fix that. But underlying all of that will be the fact that we are in the peak period right now. And perhaps five, 10 years from now we'll be able to look back in the rearview mirror and say, oh yes, we peaked sometime during that period. But meanwhile we need to understand this underlying problem and be dealing with that rather than simply trying to put out the immediate fires.

As a part of our strategy, I think we need to think globally. And here, Colin Campbell, who is one of the global figures – retired petroleum geologist – one of the global figures who has been warning us about peak oil for some time – has authored a global oil depletion protocol. And I spent a few days with Colin in Ireland recently, and he helped me understand how vitally important this is because with out a global oil depletion protocol, first of all, prices are going to become so volatile that they will wreck any opportunity to plan our future. Whether we're talking about a company, a town, city, state, a nation, it will be impossible to plan our economic future unless we have some assurance of stable prices. And the only way we'll have that is if we have some means of moderating supply and demand. Also if we don't have a global oil depletion protocol, we will have conflict in the world over remaining oil supplies. And that conflict itself will exacerbate the problem because that will take oil supply offline. And it will be a self-reinforcing, self-catalyzing problem.

So in order to deal with that, we need to have some kind of international agreement to systematically and cooperatively reduce production and reduce imports. Now historically, we've almost always had some control on price and on production, whether it was Standard Oil back in the late 19th century or the Texas Railroad Commission starting in 1935 and going up to 1970 when U.S. oil production peaked or

OPEC from 1970 to the present. Now none of those mechanisms work. OPEC is producing virtually flat out. So unless we have some other mechanism for moderating production and therefore price and therefore competition for remaining supplies, I think we're in for a difficult time. And I believe that the oil depletion protocol is our best last shot at avoiding what could be an economic and geopolitical Armageddon.

At the same time, I think communities around our nation need to begin focusing their strategies. And I have been travelling around the country speaking to city counsels and citizen groups in various places about what can be done to size up vulnerabilities and strengths at the local level to begin dealing with the impacts of peak oil. The pain is going to be felt very largely at the local level, where people will no longer be able to get to work or to get to the store where they can buy their stuff. The stuff won't be getting to the store because the trucks won't be running. People will be having difficulty heating their homes. So these are problems that will have to be managed largely at the local level. And so city and county officials need to be alerted and need to be strategizing and planning for long term emergency services – finding ways to produce food, more food at the local level for local consumption, making sure that local water supplies are tied to energy sources that are not vulnerable to this problem.

I was just a couple of days ago in Flagstaff, AZ, and they're pumping their water from 2,000 feet under ground. Imagine the energy intensity of that. And meanwhile Arizona state law says that they can't capture rainwater. Private individuals can't capture rainwater. This is insane. That puts people there in an extremely vulnerable situation. So every community has to assess its situation in this regard and see what its vulnerabilities are.

So there are lots of things that can be done, and of course we will be hearing more about those in the second set of presenters. But I think it's important to realize the nature, the scale, and the scope of the problem that's facing us. It is enormous. Thank you very much.

(Applause.)

REP. BARTLETT: Mr. Heinberg mentioned the fact that part of the solution to this problem is going to be the action of local officials, elected officials. And I'm pleased that several have joined us today – Delegate Sue Krebbs from Carolyn Howard (ph) County, Delegate Joe Bartlett from Fredrick County, Senator Bob Cooper came all the way from Hartford County, and Chris Shank from Washington County. Thank you very much for joining us.

(Applause.)

Many people will tell you not to worry because the market will take care of this. As the price of oil and oil products and gas and gas products goes up, people will conserve, and we will start looking for alternatives. I just wanted to give you one little indication of how challenging this is. Mr. Heinberg mentioned the energy density of these fossil fuels. One barrel of oil – 42 gallons – the refined product of which you can buy at the pump now for a little over $100, will provide the work output of 12 people working all year for you. And you pay just a little over $100 for it. To give you some idea that that's probably correct, Mr. Heinberg used this little analogy. Imagine how far that one little gallon of gasoline takes your car. In our Prius, it takes us an honest 45 miles. In your SUV, it may take you 10 miles. By the way, water is still more expensive in the grocery store than gasoline is at the pump. But reflect on how far that gallon of gasoline takes you in whatever vehicle you drive and how long it would take you to pull it that far. Now I know you can't pull your SUV, but you could use a come-along and chains and hook onto the guardrail, and by and by, you could – what, you get 12 miles out of it? By and by you could pull your SUV – would take you several days, I think, many days to go 12 miles.

That's the energy density in fossil fuel, and that's the challenge we have. Another little example of this: If you go out this next weekend and work really hard all day long in your yard, I will get more work out of Electric Motor with far less than 25 cents worth of electricity. Now that's kind of humbling, isn't it? That you're worth less than 25 cents a day as compared to fossil fuels. But that's the challenge that we face.

Mr. Heinberg mentioned the necessity to anticipate peak oil so as to avoid problems. The National Academy of Scientists has said that if you wait until peak oil is here, there are going to be very serious economic consequences. If you anticipate it by 10 years, there will be meaningful economic consequences. To avoid economic consequences, you're going to have to anticipate it by 20 years.

I would like to note that we here in the United States have pretty much blown 25 years. Hubbert (ph) predicted that we would peak in about 1970. We did in 1970. By 1980, we knew we were well down the other side of Hubbert's peak. When Reagan came to office, it was very obvious that we were producing less oil in this country than we had been producing. And so his solution to that – totally the wrong solution by the way, but who knew at that time? His solution to that was to give our oil industry incentives to drill, and he did that. And boy did we drill, but we didn't find any more oil. And by the way, you cannot consume more oil than you find. And a little later, we will have a chance to look at the amount of oil that the world has found and the amount of oil that we have used and how much there is yet to use.

A couple of congresses ago, I was privileged to chair the Energy Subcommittee on Science. And one of the first things we did was to try and determine the dimensions of the problem. So we had the world's experts in on the amount of oil that remained. And it was – there wasn't much variation. It was between like, what, 960 and 1,030 – about 1,000 giga-barrels of oil. That sounds like a lot, doesn't it? A trillion barrels of oil, but the world uses 84 million barrels a day. We use, by the way – this one person in 22, we use a fourth of all the oil that's used in the world. When you look at this thousand giga-barrels that remains and the rate at which we are using it, and it comes out to about 40 years. Now we're not going to run along a 40-year level and fall off the cliff. It's going to go down following this bell curve. It's going to go down.

Well, we're pretty much on time. We'll take a break until about half past to give you a chance to stretch and come back promptly at half past for our second panel. And there we're going to look at what we can do about this.

(Break.)

REP. BARTLETT: We've done a very good job so far of keeping on schedule, and so we'll try to keep on schedule by starting when we told you when we told you we would start the second half of our program today.

We have another elected official with us, Mary Margaret Whipple from the state senate of Virginia. Thank you very much for joining us here today. (Applause.)

The first 200 people who arrived today will be getting a free oil poster. I've just started to read that. It's pretty much like reading – it's a pretty good textbook and it's really a very good poster. And this is free to teachers. If you will call oil poster – I mean, if you will go on the net – oilposter.org – and tell them you are teacher, they will be happy to send you a free poster. This is really a very good poster. It summarizes most of the things that we are talking about here today.

Donald Wulfinghoff earned his B.S. in physics from the University of Louisville, a M.S. in physics from the University of Florida. He has been a researcher, consultant and teacher in energy efficiency, where he has served organizations in the White House to heavy industry plants, to small schools, to the most complex hospitals. He has authored "Energy Efficiency Manual" and "Managing Your Energy." That "Energy Efficiency Manual," I wish you had one on the desk. That really is an impressive book. He spent 20 years writing it. Mr. Wulfinghoff is probably the world's expert on efficiency in buildings and he reminds us that more energy is used in our buildings than in the transportation sector. It is not nearly as obvious, but the opportunities for conservation there are enormous.

Mr. Wulfinghoff, thank you very much for joining us.

(Applause.)

DONALD WULFINGHOFF: Good morning, everyone. And thank you, Congressman Roscoe Bartlett, and thanks to your brilliant energy advisor Dr. John Darnell for inviting me to speak with you – that's the infamous book – for inviting me to speak with you today. You have heard – you've got my notes. There we are. You've heard from the world's experts on energy supply where we're going. It's my job to outline how we make a soft landing. The purpose of my discussion is to show how the United States can continue to thrive, be free, and be happy in a world where energy is very expensive and occasionally scarce.

I'm going to make a distinction between the terms "energy efficiency" and "energy conservation." They are different concepts. However, for the sake of time, I'm going to use either one of those words as shorthand for both rather than make the distinction. My talk will be about the transition period, not the long term. The transition period is the interval during which we prepare to live within the bounds of the reduced quantity of energy that will be available in the future and the higher price that will occur in the future.

The transition actually began in 1973 with the Arab oil embargo, and it is important to understand this fact: Virtually every idea and virtually all the technology needed to make the transition was developed in the '70s. We do not lack for ideas and we do not lack for technology. What we have to do is we have to get the right ideas and the right technology in the game and the wrong ideas and the wrong technology out of the game.

Since the mid-1980s there has been no progress in energy efficiency in the United States and in most of the world. We have to restart the progress toward extreme energy efficiency – not just little energy efficiency, extreme energy efficiency – for the reasons that you heard this morning, and that process has to be managed effectively. So what I'm going to try to do in a very short period of time is to show where energy is used and where it is wasted in the United States economy to estimate the savings potential in each sector of the economy and to recommend the actions needed to make a soft landing in the future. The logic of efficiency has already bee covered. We're rapidly exhausting fossil fuels. By default, what's left is renewable energy, but renewable sources, no matter how optimistic you are, during the transition period at least, cannot cover more than a fraction of our current consumption. Therefore, finally we have to live with a much smaller quantity of energy consumption fulfilling the same functions that we do today.

Now, the good news is that a very large part of present U.S. energy use is fat. It can be eliminated without harm to our quality of life. But we have to make that happen, and it won't happen by itself and the previous speakers were very good about telling us that time is of the essence. If we stay one year ahead of the curve, we'll make a soft landing; one year behind the curve, catastrophe. I believe that.

Effective action starts by identifying all our opportunities for saving energy and then pursuing each option systematically. There is no magic bullet. Achieving energy efficiency requires many diverse actions in the different sectors of our society. Each action requires its own people, it's own techniques, it has its own economics, and each action has obstacles that must be overcome.

Okay, U.S. energy we can break down into three sectors: transportation, buildings, and industry. We'll start with transportation, which is 27 percent of U.S. total energy. It is the smallest sector of energy consumption; it is, however, the most critical. The reason that it is the most critical is that most transportation is fueled by oil. As a nation, we drive to work. If we run out of oil, we can't get work. We can't get to work, we can't buy food, we can't pay the rent, we can't pay taxes, and wherever we work, it shuts down – catastrophe, and it happens pretty quickly. So we're highly vulnerable on oil.

Fortunately, transportation offers a very large potential for reducing energy consumption and – very important to understand – no new technology is needed. The needed changes are remarkably free of external obstacles, unlike the other sectors. Most actions can be initiated individually or market forces will drive them. The biggest need is for awareness of what we need to do, and the biggest obstacle is distraction by ineffective solutions.

So, transportation energy is the biggest threat to our survival but it's also the easiest place to make major reductions. There are three main transition-era strategies for transportation. The first is much more important than the second; the second is much more important than the third. The first one is to minimize transportation. We transport way too much and we transport unnecessarily way too far. This is not a technology issue. The second is to improve vehicle fuel economy, and third is to shift away from petroleum fuels.

So let's look at this most important technique, which is to minimize transportation. There are four basic – look at the odometer of your car and see where the miles go. The largest number of miles probably go to commuting. Commuting is entirely unproductive. It wastes vast amounts of fuel and energy for the manufacture of vehicles. Everyone hates it, so it isn't something we want. The solution is to live near where you work or to work where near you live. The action is individual, it is entirely voluntary, and it is feasible immediately. Furthermore, it has some great advantages: huge increase in productivity. If you're sitting in traffic two hours every day, you're wasting two hours of your prime daytime productivity. You arrive at work tired. Get rid of those two hours wasted. Large saving for household costs for vehicles; maintenance and fuel; reduced highway accident death and injury; reduced respiratory disease, sucking other people's exhaust fumes; reduced lower-back trouble, which is chronic in our country, which is largely the result of sitting on car seats; and improved physical fitness. So this is just a win-win-win-win-win-win situation. Get rid of commuting.

Okay, then if you look at your odometer again, the second-largest place where we do a lot of wasted driving is repetitive things that we do on a daily or several-times-a-week basis – grocery shopping, children's soccer practice, dining out and so forth. This is tougher. The solution is a return to small, self-contained communities, perhaps communities within larger cities. Action is voluntary but it requires a whole new market for housing of a different kind.

Now, when you start talking about reorganizing how we live, some people get a terrible case of fright, but there is no need for that because we know how to do this. U.S. communities will simply return to a style of life that has existed for most of the history of the United States, and if you talk to any American who has spent time in Europe – I hate to use Europe as an example of something – of a place where they do something better, but the simple fact of the matter is you go to Europe, you spend time there for a couple weeks, and you come back raving about how great it is. You can walk to everywhere; perform all the daily functions you need to perform just by walking around. So that's the solution for that.

The third type of transportation will take care of itself. This is occasional long-range travel, going to conferences on the other side of the continent, taking the entire family to Disneyworld. Such travel is highly discretionary and there are alternatives. It'll take care of itself. No need to worry about that one.

And finally, minimize freight transportation. We heard about that this morning and I agree entirely with the other speaker. The freight system is already very efficient on mile basis. However, we transport way too much stuff. And what we're going to have to do is return to a culture of thrift. And people say, oh, gee, don't we depend on growth? No. For as long as this civilization has existed, from the time the pilgrims arrived up until about 50 years ago, thrift was the basis of the strength of the United States. We're simply going to go back to that.

The second major technique is improve vehicle fuel economy. This will come mostly from reduction of weight and drag of vehicles, not from any major improvement of motor efficiency, not during the transition period. It might happen but I wouldn't count on it.

Dr. Darnell, who is Congressman Bartlett's energy advisor, sent me a nice clip of a Volkswagen prototype that, in a very carefully orchestrated test run, got 300 miles to the gallon. We're not talking mopeds or motorcycles here. This was a real car but it was a two-person car. It went fast – drove down the autobahn at autobahn speeds – safe, gets you out of the weather, but kind of exotic. If we make it realistic, 100 miles per gallon is a perfectly reasonable target.

And finally, the least important for the transition period is to shift away from petroleum fuels. Petroleum, of course, is the critical issue here, but the only thing we can do during a transition period that I can come up with is that we reduce driving radius to within the radius of electric cars. You are not going to increase the radius of electric cars simply because the laws of chemistry only allow you store so much energy in a battery.

Overall, we can radically improve transportation efficiency with the means that exist today. The biggest hazard is being distracted by ineffective solutions. Some of you are not going to like this, but the stuff we have to get over that is not going to be a solution is, first of all, mass transit. Mass transit is a social service. It does not save energy. It can't save energy except in very limited environments like Manhattan, for example.

Hybrid cars. It's a very easy calculation to show that hybrid cars, once you include the extra energy that it takes to manufacture a hybrid car, and once you compare, on the basis of similar weight, speed, acceleration and so forth, hybrid cars do not save energy. Hybrid cars are a political phenomenon, not a technical improvement.

The hydrogen economy is a bunch of fluff. It's perhaps somewhat more legitimate than desktop fusion, but that is a concept that will evaporate and go away. So hydrogen economy, according to the opinion of many people, me being one, is just a hopeless diversion.

Coal-derived fuels we've heard about – yeah, you can do it. The Germans fought World War II with coal-derived fuels, but you're trading one big problem for another. So we don't go there.

Ethanol. According to the best experts that I have listened to – Dr. Pimental and others – ethanol is a break-even; it's a net-energy loser probably and it has horrible environmental consequences. That's just the wrong way to go.

Telecommuting. I disagree with one of the previous speakers. I think there is very little work that is done in this country that can reasonably be done by telecommuting. So we need to do the things that really will work and not get distracted by stuff that won't work.

So summarizing transportation: The most important action is for people to organize their travel and living arrangements in a way that is desirable in itself, and if that is done, everything else will fall into place with a minimum of government action. So this is for you to do, not for the government to do – in contrast with the next sector, which is the building sector, which is the largest sector, 39 percent of total energy consumption, which is loaded with obstacles which will require a kick from government – an educated kick from government to overcome the obstacles that we face.

Characteristics of the building sector. First of all, it splits two ways. Housing is 21 percent of total U.S. energy consumption, and non-residential, which is office buildings, hospitals, schools, shopping centers and so forth, is 18 percent of total U.S. energy consumption, and those are two entirely separate worlds with different people, different set of rules, different licensing and so forth. Buildings use electricity – a lot of electricity. They also use a lot of natural gas, which is being depleted to a lesser extent. They use propane and petroleum, which is certainly also being depleted.

Both residential and non-residential buildings today use about five times more energy than is economically reasonable. And the implication of this is that buildings offer a tremendous opportunity for improving efficiency. Our target should be and is possible to reduce building energy consumption to one-fifth of what current building energy consumption in on average. The bad news is, you'd better do it before the building leaves the drawing board, because once the concrete hardens, most of the major opportunities for improving efficiency have either vanished or it becomes very expensive to retrofit that building. So you've got to do it from the get-go. No new technology is needed, once again, but there are a few items that we would like to have.

Progress in building efficiency has absolutely halted and even regressed. In the housing sector there was a one-time improvement in efficiency around the '80s as a result of increased insulation, but now housing efficiency is regressing, and in the non-residential sector, non-residential buildings – office buildings, buildings like the one we're sitting in – have never been less efficient at any time in human history. They just keep getting worse and worse and worse. So there has been no progress in the non-residential sector.

We talked about this. We'll skip it. I'm going to give you a four-step outline for improving efficiency in residential housing. Now, we're talking super-efficiency here. We are not going to do incremental improvements. We are going to go all the way. We are going to build buildings from this day forward that use 20 percent of what buildings conventionally use. What's the conventional cost, oh, by the way? Five to 10 percent increase in construction costs of the house, no increase whatever in the land value, which is now getting to be the big part of the price tag.

So it's very cheap but it's a four-step process. The first step is insulation. We're going to radically increase the amount of insulation and we're going to distribute the insulation much more intelligently – it makes no sense to have three-and-a-half inches of insulation in the wall and 24 inches of insulation in the ceiling. That's ridiculous. In this climate zone, the walls are going to be 12 inches thick – 12 inches of non-flammable fiber insulation. That's the standard throughout the mid-latitudes. We're going to adopt good insulation practices. The current practice of three-and-a-half inches of fiber plus one inch of foam insulation board is horrible. It's a bad practice from a variety of standpoints. It makes for a very weak building, moisture problems and a bunch of other stuff.

And we're going to exploit the opportunity as we're making the buildings more efficient to make it more desirable in all other ways. We're going to make that building with its 12-inch wall and its good connections, essentially hurricane proof, essentially earthquake-proof, and at very little increase in cost.

The next item of the outline, the second item, is windows. We avoid excess glass because glass is the single-largest source of heating and cooling costs in buildings today. We're going to locate glass for efficient heating, cooling, view and daylighting, and we're going to use external shading on houses so that no direct sunlight ever hits any window during any part of the year when we want the inside of the house to be cool.

The third part of our outline, the layout of the rooms and the heating and cooling systems -- you live one room at a time, so you heat and cool the house one room at a time. And you automate this process. You do it with programmable thermostats, which you can buy at the hardware store, and you do it with occupancy sensors, which you can buy at the hardware store. We don't need new technology. We cluster and isolate rooms for efficiency and convenience. Fortunately, the most convenient clustering of rooms is also the most efficient. And we select our heating and cooling equipment for efficient isolation and low fuel costs. In this climatic zone, the entire mid-latitudes, we have two choices. One will be hot water heating; the other will be heat pumps, for a variety of reasons I don't have time to go into. The central forced-air furnace is history. It's a bad system. We're going to get rid of it. It won't exist anymore.

And the fourth part of our four-step outline for housing is appliances. And this one is dead easy. You simply select the most efficient, practical model of every appliance, whether it's a toaster or whether it is a heating boiler, an air conditioner or whatever. We have an existing system of appliance efficiency ratings, and it works very well and we're going to use that system.

Now, let's jump over to buildings, what we're going to do to make non-residential buildings efficient. We have to use a totally different approach because unlike housing, nonresidential buildings are designed by licensed professionals, several different licensed professionals – four, in fact – each of whom has a different piece of the action in the construction. In the external structure of the building, the architect is the responsible party. We're going to improve insulation radically. We're going to size and locate glass properly for view and daylighting, and we're going to use external shading effectively. The current glass-box building is history. It's the worst development in the history of architecture. It's terrible malfeasance, and we're going to get rid of that and lightweight curtain wall construction.

In the case of the heating, ventilating, air conditioning systems of nonresidential buildings, the mechanical engineer is the responsible party. Unfortunately, the mechanical engineers are still struggling to learn how to design efficiently, and two weeks from – well, approximately two weeks from today in Lausanne, Switzerland, there is going to be unveiled a radically new approach to HVAC design. It's appropriate for the coming century. That will probably take a couple of years to get into the mechanical engineering profession.

And thirdly, lighting. Unlike housing, in non-residential buildings, look up in the ceiling – lighting is about 40 percent of total energy consumption in a lot of buildings – this room, right now, for example – and so that unfortunately is the responsibility of nobody. Sometimes the architect does it, sometimes the electrical engineer does it, sometimes a group of unlicensed people called lighting designers do it, and none of them have a handle on energy efficiency.

What we're going to do is a variety of things, but the two big changes are going to be task lighting, which is a concept from the '70s which was never properly implemented, but now we know how to do it. It's in here, and we're going to follow the task-lighting prescription in Section 8 – or, no, sorry, Section 9 of the "Energy Efficiency Manual," and that's how we're going to do lighting in the future. And then we're going to learn to use lighting controls efficiently. A lot of our lighting in buildings goes to lighting empty space. There is nobody there to look at anything. So we're going to learn to eliminate that source of waste.

Okay, what are buildings going to be like after the transition? The basic building types will remain unchanged. There won't be any big, revolutionary changes in the buildings in terms of the utility of the buildings. The internal layout and usage will be largely unaffected. The occupants will hardly notice a difference, except that they will be more comfortable and they won't have diseases. They won't have indoor air-quality problems. The exterior appearance is different – radically different because we're going to fix all the architectural negligence. Design is rigorous for efficiency. The design is more standardized. Buildings will monitor their energy usage from moment to moment, much as luxury cars now do.

Comfort problems, totally eliminated. No cold spots in winter; no hot spots in summer. Health problems. Sick building syndrome, Legionnaire's disease, all gone – fixed. Fire resistance greatly improved. Buildings will last much longer and they will be more trouble free. And, very important in the non-residential sector – very important – buildings will be much more, and inherently, terrorism-resistant. I wish we had time to talk about that.

Okay, design approaches to avoid, just as in transportation, we don't want to go chasing butterflies. The biggest butterfly, in my opinion – and this relates to the developed world, the United States – is a tendency to want to link the development of renewable resources to the development of energy efficiency; in other words, self-sustaining buildings, or in the extreme case, buildings going off the grid. That's nuts. There is no logic to that whatsoever.

I do not make my own shoes. I buy them from a shoe factory. I do not have my own cattle in the backyard. If I want a hamburger, I go to McDonalds' and buy it. And even though I'm an energy expert, I don't make my own electricity. I get it from Pepco, because they're the experts in doing it and they know how to do it most economically. So we've got to get away from this kick of the self-sustaining building because if we try to marry renewable resources to energy efficiency, we will destroy progress in both. They must be pursued independently.

Obstacles. This is the weird part. There is not a single school of architecture, not a single school of engineering in the United States where a student can go and learn to build an efficient building. It's as if our doctors had no medical schools, and this bizarre situation has to be fixed. Professional knowledge of building is still being organized and there is no effective constituency to promote energy efficiency at the present time. Worse, energy efficiency is resisted by the self-same licensed professionals who have a public responsibility to build efficient buildings.

The obstacles are numerous and entrenched and there is one way you're going to get rid of them. And I'm getting short on time so I'll summarize this.

Here is how we're going to have energy efficiency in buildings. You say to the owner, the architect, the engineer, the developer, you will not get a permit to build this building unless is satisfies stringent and extreme energy efficiency codes. And if you, Mr. Architect and Mr. Engineer, build a building and if we go in and measure it and it doesn't meet those standards, we pull your license. You do something else for a living this day forward. That's the only way you do it. Once you have done that, you've got the attention of the professionals. Then you can start educating them about how to save energy. I wish we had time to talk about energy codes and why they're important, because they're extremely important.

So, summarizing buildings, the efficiency potential is huge. The efficiency potential is not being tapped because licensed professionals with a public trust are not behaving professionally, and the main role for the public, that's you, is to light a fire under the professionals and make them design buildings properly.

We're not going to talk about the building sector because we're out of time. I'll just summarize by saying that improvements in the building sector are limited for the reason that it is the only sector in the U.S. economy that since 1973 has made a large and significant improvement in energy efficiency.

And I think the fact that the screen just blanked off is a sign that I'm supposed to quit. So thank you very much.

(Applause.)

REP. BARTLETT: Thank you very much.

John Spears is a certified energy manager and was named the Region 2 environmental professional of the year 1995 by the Association of Energy Engineers. He has developed energy and environmental policy for all levels of government and pioneered the development of many energy conservation, solar and indoor air quality technologies. His passive-solar homes have been published in many popular magazines – Better Homes and Gardens, Building Ideas, Popular Science and others.

Mr. Spears.

(Applause.)

JOHN SPEARS: Good morning, ladies and gentlemen, Congressman Bartlett. Thank you very much for giving me this opportunity to give you my perspective on this issue. I've been involved in energy efficiency, renewable energy policy, design as a designer, policymaker and so on since the early '70s, and the way I see it is that we currently live in a totally unsustainable world, based on 18th century technology of fossil fuel boilers, internal combustion engines from the industrial revolution, and it can't continue. Whether we like it or not, as we've seen this morning, cheap oil is going to run out in our children's lifetime, and it's going to be their kids that are going to have to deal with the world that we leave behind if we don't do anything about it.

We don't have any options when it comes to fossil fuels. They are limited. The only options we have are renewably based technologies, and we must begin today while we have cheap oil, to move towards a 100-percent renewable energy-based economy, and that's what I want to show you is absolutely possible today.

Let me start with a quick example on a much smaller scale. Let's say this room is the universe and we want to provide power for the lights and the air conditioning in here. The first thing we do is go get a generator. We happen to have a gallon of gasoline to run that generator and we also know that there is a guy next door that has got all the gasoline we could ever use, so all we need to do is go over and make nice with him and we can keep our generator running.

Energy efficiency is real important so what we should probably do is change out the light bulbs and improve the air conditioning system so our gallon of gas lasts longer, and we can put off dealing with the guy next door. However, we have another problem. Long before the gasoline runs out, we're all going to die of carbon monoxide poisoning. This is exactly what's happening today on the planet. We are consuming fossil fuels as fast as we can and killing ourselves in the process. There are three fundamental fatal flaws with this, which I'll get into in a minute.

The other option to powering this room would be to first look at what we need. We need light and air conditioning. We can reduce that energy consumption by 60, 70 80 percent by poking some holes in the roof to let daylight in and turn the lights of, allowing natural ventilation – it's probably a very nice day outside – and ventilate the room, and we can eliminate almost 80 percent of the energy requirement. The balance of that energy, we hang a solar panel out the window, collect some solar energy, use some of it to power the building's needs during the day, some of it to charge some batteries and some of it to separate oxygen from hydrogen and store it to be used later in a hydrogen fuel cell to power the building later.

The hydrogen fuel cell uses only hydrogen. Its byproducts are only water vapor. That water vapor can then be re-separated and made more hydrogen from the solar panel. That system will last approximately 7 billion years – much longer than a gas generator.

So the three fundamental fatal flaws of our existing system are, one, it's running out. We know it's running out. We heard all these people this morning talk about how quickly it's going to run out. Put it in perspective: that's our kids' lifetime. It's their kids' lifetime, our grandchildren. That's the perspective we're talking about with radical shifts in society. We need to do something about it now. And that's not really taking into full consideration, I don't think, the impacts of the growth in China and India, which have huge appetites for oil and gas. China will soon pass the U.S. as the largest consumer of imported oil and tension between the U.S. and China over oil are real. I do a lot of work in China for the Chinese government and I know this firsthand. The U.S. (sic) tries to consume as much oil on a per capita basis as the U.S. does, we're in serious trouble.

The second fatal flaw, it's killing us. Fossil fuels are polluting the land and the air and the water, causing global warming. Some people have said New Orleans is the first city to be lost to global warming. The health costs to individuals from air and water pollution have a direct impact on all of us. People are dying every day from cancers and other diseases caused by environmental pollution from burning fossil fuel.

And the third fatal flaw is it's controlled by a few. In fact, it's controlled by a few people that don't like us very much. We import more of oil than we produce, and we import it from countries that don't like us and are in fact breeding grounds for terrorists. Whether we like it or not, we're held ransom by the Arab oil countries and other oil-importing countries. And this has actually become the basis of our foreign policy as we try to protect our oil imports, and will probably become increasingly so. Imagine what would happen if OPEC decided not to sell us as much oil as we wanted.

The other problem is the fact that central government has the central control over our energy, water and basic life support systems. This didn't used to be true. It used to be that you could live quite comfortably, and this country was founded on personal freedom to allow you to live comfortably and not be bothered. Today you can only live comfortably if you can afford to pay the electric bill or afford to pay for the gasoline, which has a serious impact on our liberties and freedoms. New Orleans is another perfect example. As soon as the central energy, water and sewer system shut down, the city became unlivable and had to be evacuated. There were no options.

This diagram shows what our current system looks like. It's basically a systems diagram of the system of our society. It's based on inputs of energy. Those inputs of energy are running out, they're owned by other people, they go into the system to produce the goods and services that we need to provide the quality of life we're used to. The output from those systems are directly polluting the very things that are required for life – clean air, clean water, and soil to grow crops on.

The alternative to that is a model from nature, or a regenerative system – a system that can sustain forever. Inputs to the system are completely renewable sources. They produce all the goods and services for the community. There is no pollution line. And everything that's produced can come back into the community and cause it to grow. This is the model that's found in nature long before human beings ever inhabited the planet.

We have options. We have lots of options. And what I want to show you today is my personal experience with my options over 30-some years as a professional in the business, and I'm going to show you options that are real and today, not future technology, and a lot of these options you can find in Maryland.

The first one is solar. Solar (portable takes ?) are a magnificent technology. You take some sand, you can make a solar panel out of it. It makes electricity. It will do that – until you smash it with a hammer it will keep doing that. Two kinds of systems, one directly plugs into the grid, so you use the power when it's being generated. If you're generating more than you need it goes into the grid so somebody else can use it. And we have a nice law in Maryland that allows the meter to spin backwards if you're not using as much as you're generating. On a sunny day, my meter spins backwards as fast as most people's spins forward.

The second system – there we go – incorporates batteries. Now, this system allows you to have power at night and power when the grid goes down. It also sells power back to the grid when you use more – when you make more than you use, but it also give you backup power for days when the grid goes down. When we had that bad hurricane a few years ago we were out of power around here for a week. My home and office continue to operate on the battery backup that we had built in, charged by the solar panels when the sun came back out.

This is the system that powers my house and office in Gaithersburg, just 30 minutes from here -- two kilowatts of solar panels manufactured here in Fredrick by the Solarex Company. To the right is the inverter that takes that energy and turns it into AC energy so it will go into the grid, and the battery pack.

This is another project in Darnestown, Maryland. This is a six-KW system done for a Buddhist temple, and this place was built as a refuge for people in case of hard times, whether that be disaster or economic problems.

These can also be built at the utility scale. At the utility scale – lots of utilities are working on these, particularly in the sunniest climates – Arizona and New Mexico and so on, either (portable takes ?) or sun concentrating to solar thermal system. This particular one, called Solar II is a 10-megawatt solar plant that uses melted salts to store the thermal energy for the night so the power plant continues running through the night. It is not just a daytime producer.

Mirrors focus the sunlight to a boiler at the top of that tower that produces steam and then generates electricity conventionally. These two systems use different types of focusing collectors – on the left one on a trough that makes the hot water, and on the right, those mirrors focus on what's called a sterling engine that makes the power directly. The Pentagon has a number of these units on the right installed just a year or so ago.

Wind energy is another resource. The nice thing about wind energy, it's actually cheaper to build a wind energy plant than any other kind of power plant. It's cheaper to build a wind energy plant than a coal-fire power plant. It's significantly cheaper than diesel or any other kind. The question is where are you putting them? You've got to put them where the wind is. You can't put it someplace where there is no wind. So this is a map of the U.S. of the various areas where wind turbines make a lot of sense. This is a utility scale power system because they plug into the grid. But it is the fastest-growing energy technology today, growing at approximately 30 percent per year.

These are just some pictures of some large-scale wind turbines. They're getting bigger and bigger every day. You can now put a megawatt power plant up in one wind turbine. And a lot of farmers like these because you can continue to farm underneath them. They don't take up any real estate really.

Here's a couple of local examples. The one on the right is – (unintelligible) – Foundation downtown Baltimore, and we did that back in the '80s, and the one on the left is a combined wind/solar system powering an island for a family on the eastern shore.

Buildings can be self-sufficient. Buildings can absolutely take care of all the life-support needs of the family. They can do that by providing power with solar, heating with passive solar, and active solar systems – hot water from solar. Water can be collected from rainwater and stored in a cistern. Waste can be completely processed in composting toilets and kitchen composters for use in fertilizing gardens for producing food, which can also be carried through the winter in solar greenhouses.

This is one of the first examples of a completely self-sufficient home that was built in Prince Edward Island, Canada – very, very harsh climate. This house combines a house, you'll see on the right there – the house is on the left-hand side – and a very large commercial greenhouse, which grows food, both vegetables and fish in large fish tanks. The greenhouse also processes all the waste from the house. This house uses no external source of energy. It's 100 percent self-sufficient for a family of four. Granted, it's a bit extreme.

This is a smaller-scale model that is actually a small greenhouse that can be added to anybody's house. It does all the same functions. With a composting toilet producing the fertilizer for the gardens and the gray water from the sinks and showers and so on to water the garden. And then the greenhouse also provides heat to the house.

This is one of the modern composting toilets we're using in houses today. It uses one pint to flush toilets. The composter is in the basement. What comes out is about the same consistency as the bags of compost you buy at Home Depot to put on your garden, and you need to empty it out maybe once a year. These are very efficient, use no water. In Fredrick we've had severe water problems over the past three years that have stopped development. This is a solution to that.

This is a design of a system, a completely self-sufficient house, that I developed when I was the senior architect at the National Association of Home Builders Research Center in the early '80s. This house is a modern example of doing everything you just saw in a house that might look like a Ryan home in a development here in Fredrick. I won't go through all of the details on it, but basically it's got the greenhouse, it's got the food production, it's got complete waste processing. Heating and cooling is done by a geothermal heat pump, which is the most efficient source of heating and cooling you can do. It collects water, has battery backup. I could spend all day doing a workshop on just how this house is done, but it's completely off-the-shelf stuff.

Here are some other examples. These are what they call zero-energy homes – homes that produce more energy than they use on an annual basis. They're being built now all over the country. Examples: Colorado, Montana, Florida, Arizona. This one here, down in the lower-left-hand corner is in Virginia. They actually built that on the Mall first to show it off and then hauled it to the permanent site in Virginia.

These are some houses just locally that I'm currently working on. They're built out of compressed earth bricks. We're not even using lumber from Canada; we're taking the dirt from the site, compressing it and making bricks and building the house from the material on the site to make houses that use no energy. That building on the right is my office, which by the way is on the solar home tour, which is next weekend. If any of you are interested, it's free to the public, and there are homes all over the region that you can tour that are completely solar-powered.

This is a very exciting project that you'll all get to participate in. Congressman Bartlett initiated this project to build a completely off-the-grid, self-sufficient building that everyone could see and understand the technology. This is a visitor's center that's being built on I-270 just south of here at the overlook, the scenic overlook. And this is – it was a competition from colleges all around the region, and this was the winning solution. It is currently in final design. It will be built starting, hopefully, this fall, and this time next year we'll be giving tours of it. It is completely off the grid and self-sufficient. Again, we could do a whole day on just this wonderful building.

In two weeks you'll have the opportunity to see many of these kinds of buildings built on the Mall by college students in schools of architecture from around the world, including Puerto Rico, Spain, and other countries, and Canada. The building on the lower left-hand corner is the University of Maryland entry. These buildings are completely self-sufficient, solar powered with all the features, maybe save the greenhouse that we discussed – on the Mall October 8th through the 16th. Don't miss this one.

Communities are the next level. We can make the house self-sufficient. It's actually probably better to think about the whole community as being self-sufficient – new way of development. I can't get into too much detail here, but what I wan to show you, I want to get to, is a real example of 100 percent renewable energy. And it's not just for the rich folks. These are low-income rehab projects. We've done Baltimore, $30,000 to build solar homes that use less than $100 a year for utility bill.

I've done a lot of work around the world designing and building communities. This is in South Africa. Did I just get cut off or – okay. The village plan – again, I'm going to skip through this rather quickly. You can see this stuff on my website so I won't go into it in too much detail. Basically it's based around community gardens where people can grow their own food, a town center where they can sell the food. The energy system is a completely – this is in a Chinese project – energy systems completely self-sufficient using the economic engine of a pig farm, using the waste from the pig farm to make methane gas. Methane gas then powers the homes. This is pictures of the gas holder, digesters, the engines and the generators. This community is 100 percent off the grid using waste from a pig farm.

Biofuels – we've heard something about that, but biofuels are homegrown energy. We absolutely can't live without them. I'm having a little issue here; I 'm going to skip through this. We can run vehicles on anything that contains carbon. We have the technology to convert just about anything to carbon, including waste. Municipal solid waste – where do I have to point this thing to make it work? Does anybody know?

MR. : (Off mike.)

MR. SPEARS: Okay, there we go.

Ethanol is about the cheapest thing. Right now we can produce ethanol at about $1.30 to $1.80 a gallon. We're working with a company called Ekron (sp). It's currently planning an $80 million gallon per year ethanol plant in Baltimore. Most of that's going to come from corn, most of that from the state of Maryland, and also $30 million from a new process that takes cellulose or agricultural waste.

Municipal solid waste – Willie Nelson is a big biofuels – (audio break, tape change) -- if you own a Prius. Some people have modified the Prius with extra batteries, charged with solar panels. At the cost of solar panels today in California, this is cheaper than gasoline, charging an electric vehicle, driving it around with solar panels that can fit on the sides of a parking space. This is cheaper than gasoline.

Also one other point. I drive a Prius, 5.E85. That's 85 percent ethanol. In my Prius I get the equivalent of 500 miles per gallon of gasoline on my Prius. All I did was buy the car and fill it up with a different fuel. You could do that, too.

Hydrogen, it is definitely the future. I am getting the stop sign so I'm going to skip through hydrogen. It is about 10 years out but we must make sure policy insists that it is generated by renewable sources.

All right, I'm going to leave you with this one. A study was done last year by these groups, mostly Germany and Japan, to look at the feasibility of turning an entire industrialized country into a 100 percent renewable based economy. This is their conclusion to that study. Energy-rich Japan report shows that the combination of best energy efficiency technologies available today and the massive investment in renewable energy could ultimately provide Japan with 100 percent of its energy needs from renewables, including transportation fuels without expensive, environmentally damaging imported fuels and nuclear fuels.

Rather than seeking energy security through its hugely expensive and polluting nuclear program, for example, Japan could instead build its own renewable energy industry. As an industry-hungry and supposedly resource poor country Japan could make this transition to clean renewable energy without sacrificing living standards or industrial capacity.

The technology is there to do it today. What is lacking is the will and commitment. I'm going to skip to this in just a second. It requires a robust mix of renewable sources and demand-side efficiency. We should not rule anything out. We should explore all options because it's going to take all options working in cooperation to make it happen. Here's just some examples of housing, solar, wind, solar-thermal and so on. Vehicles running on hydrogen, soybean oil, corn oil, any kind of oil.

This is a picture today in Nanjing, China -- southern China, where every rooftop, square foot is covered with solar panels making solar hot water, eliminating the need for coal.

We have the technology today, and it is good policy, as we've heard from the speakers this morning, it's urgent. Energy independence is the best policy for national security. Homegrown energy is good economic policy, creating jobs, stopping the drain of U.S. dollars to import oil and to fund terrorists. Every dollar that we do not export in buying imported oil creates three dollars in economic activity domestically. That is good economic policy. Renewable energy is good environmental policy. Enough said there.

Sustainable communities are resistant to natural disasters, and we have to face this challenge sooner or later. Sooner is going to be a lot cheaper than later. We need to do it while we have cheap oil. We can't wait until we're in a disaster-recovery mode. Thank you very much.

(Applause.)

REP. BARTLETT: There is a poem by Edgar Guest saying I'd rather see a sermon than hear one any day, and our next speaker must have read that book because he really practices what he preaches. John Howe is an engineer and author. He was an engineer with General Electric and Head Ski Company and division of AMF Corporation before heading his own company, Howe Engineering and Howe Winter Sports, Inc. He has written two books of note, "The End of Fossil Fuel Energy and a Plan for Sustainability," and an updated version, "The End of Fossil Energy and the Last Chance for Sustainability." Mr. Howe.

JOHN HOWE: Thank you. One thing about being the last performer in a gig is you throw away your set list and wing it. But anyway, I'm the maverick here. I don't come from a corporation or a company. My wife and I are funding this effort on our own nickel, and because we've become so concerned with fossil energy. It's just like a terminal illness. First there's the denial, then the depression, then you say, well, what shall we do. Well, we'll try to do something. We'll try to be pro-active.

We tried to research, look for all the answers, find out what's going on, and believe me, the answers and even the questions are not something that can be covered in a half hour or an hour or one session. It takes a semester course.

I thought that maybe the answer would be to write a book and try to digest all that's happening, all the aspects of the subject into at least one understandable form. And my first book was called "The End of Fossil Energy and a Plan for Sustainability." Fortunately my daughter is a publisher. She was able to put this together. We're doing this on our own nickel, on Social Security, whatever, and because by self-publishing and printing a book we can get it out in a hurry.

The first book, 3,000 copies, went out like that. We gave them away – we give most of our books away. I'm going to talk about the book a little bit more. In the last couple of years since I started the first book in February 2003 things have changed so drastically. Things are moving so rapidly, and so many new books and people have come out, speaking about fossil energy. They talk about oil. Peak oil is the buzzword now, what's the price of gas. But you've got to go further. You've got to peel away the layers of the onion. It's not just oil. It's natural gas. It's coal. That's 86 percent of our energy. What's the rest of our energy? Where's it coming from? Where's it going? How good is it?

So like I say, I'm going to give you some different approaches, some different viewpoints of what's happening here. But I want to get back to the book. The second book, I held this off – we just went to the printer in June, I guess. I held it off purposely because I wanted to get Matt Simmons' book, "Twilight in the Desert" in here because everybody was waiting for that to see what's really happening in Saudi Arabia.

So the second book, called "The End of Fossil Energy and the Last Chance for Sustainability," the last chance. The more you get into this, the more ominous the picture gets. Believe me, there are no simple answers. Again, this is self-funded, personal project. We don't have the big corporations, I don't have the PowerPoint, and if I did I'd have to change it. So what I suggest, I really offer to you, everyone of you, everybody here, write it down, send me your address on my e-mail address: howe@megalink.net. And I will personally send you a copy of the book within a week or two. We send these out all over the world.

MR. : We can't hear you.

MR. HOWE: Okay, is that better? I need a monitor here.

MR. : Just say it more clearly – your e-mail address.

MR. HOWE: Okay, and I'll tell you again at the end.

MR. : This is the only one.

MR. HOWE: Okay, this is the one that works, okay. I'll talk like this. I need a monitor up here. (Chuckles.) This is better, okay.

It's howe – H-O-W-E -- @megalink – M-E-G-A-L-I-N-K --.net. My name is John Howe, and my wife Debbie and I are doing this ourselves and we're having a lot of fun. If nothing else, we find people all over the country that are also trying to make a difference, and we have a support group all over the world. We're dealing with people all over the world now.

So to move ahead, it's clear we have a terminal illness. We've heard that over and over again. It's easy to define the problem. We have my mentors, Dick Heinberg and Matt Simmons, Kenneth Deffeyes telling us what the problem is. That's easy, to define the problem. The solutions are much more difficult. The biggest problem we have right now is that, first off, the public does not hear this. Or the public is hearing mixed messages. The choir is not singing the same tune to the public. We're squabbling amongst ourselves. This is confusing the media, confusing our leaders. So we have a terminal illness and we desperately need leadership.

Now we can deny that terminal illness, or our leaders can fail us and not give us the answers. Do we not want to hear that we have a terminal illness? And if our leaders don't tell us we have a terminal illness, and it takes us prematurely when we had a chance for survival, then I would call that malpractice, big time. So we need leadership.

Now I'm going to jump around a little here but try to stick to some sort of format. I want to jump ahead because we've heard of the problems. That's easy to define. I want to talk a little bit about what we in Yankee-speak call debunking dead-end delusions. Because the public is getting an incredibly mixed message. You've heard it right here today, this morning. How about this, how about that. This will save us, or that's coming.

First off, the number one delusion is there's not a problem. Believe me, it's a huge problem. Whether we have 1 trillion barrels left or 2 trillion barrels left, I believe it's even more serious than that. I kind of think we don't even have the trillion barrels left because I think there's a lot of phony business going on out there. The more you get into this, the more serious the problem gets. So first off we have a problem.

The second delusion is that – well, they're not in any particular order, but I call them – I have my buzzwords – hydrogen hype. I agree with one sticker, not the other. There's a book out called "The Hype about Hydrogen." Hydrogen is not a fuel source unless you take a lot of energy to separate it, and about 97 percent of our hydrogen today comes from natural gas, and natural gas I believe if you read Julian Darley in "High Noon for Natural Gas," natural gas is in even more dire straits than oil. Even though there may be a lot of it around the world, it's a stranded resource and you just can't ship it here and there and most of it that is available in the world is already spoken for. But tankers are contracted. The L&G ports are – shipping ports are contracted. And for us to build L&G ports to suddenly get hydrogen, get natural gas in USA will take a lot of time and it's just a short stop solution.

So hydrogen, in all its problems, and I don't want to go into the physics of storage and the cryogen – I'll give you a little for instance. When we send a shuttle, wasting this tremendous amount of energy to send shuttles off into space – I see some nodding heads – we should be spending energy figuring out how we're going to survive, but when we sent the shuttle up into space, it takes about 200,000 pounds of hydrogen. And when you see the pictures of Cape Canaveral, you see the fumes spewing out, it's my understanding that it takes 300,000 pounds of hydrogen to be shipped from wherever they make it in Louisiana to get 200,000 into the shuttle. That's at –460 degrees Fahrenheit. There are problems with hydrogen that you can't imagine in storage and handling and energy to make it.

Now people in our own NERL, part of the National Energy Renewable Lab, they say, well, all we've got to do – and this is our administration teaching us – all we've got to do is spin a windmill and electrolyze hydrogen and put it in our SUV's and we're home free. They've even got pictures in the Solar Today issue of the National Society of Solar Engineering. These are our leaders, these are our teachers. But what they don't tell you is that all the wind energy in USA Today, all the wind energy in one year is worth about one day's worth of gasoline. And if you put it into hydrogen at 50 percent efficiency, it doesn't work, folks. You've got to put numbers on these things. You can't make a mountain out of a tiny speck, a little molehill. And yet there's people touting this, that these are the answers are coming. That takes care of the hydrogen hype.

And the fool cells, we call them. (Laughter.) I hate to be derogatory but we have to get serious, deadly serious because the choir's singing not a tune to the public. We're arguing amongst ourselves and the public is not getting the right message. The media certainly won't pick it up and get onto it unless it's very isolated media.

Another one is the bio BS, okay. Sunlight is our source of energy, and to make the bio energy out of it, we've used bio energy for years and years. Otherwise our ancestors wouldn't have been here to make it possible for us to be here. But we denuded the woods in the Middle Ages. Just look at Easter Island. If you take more bio energy than is coming in from that sunlight, and it's very dilute, it takes a lot of area or a lot of time to concentrate bio energy. A tree does it for us, or Mother Nature did it for us millions of years ago and stored up this wonderful black stuff that we're just blowing away right now, whether it's oil or coal or whatever.

So you can't take the energy from the sun and concentrate it into a fuel and use it at the rate that we would like to use fuels. For instance, let me give you one little factoid. If we were to make – and this irks me because in Maine our democratic leadership says we're going to turn Aroostook County into a great soybean operation and make bio diesel and we're home free. Well, let me tell you. Back of the envelope. I mean, this is not really complicated science or math. If you were to make soybeans on one acre into bio fuel, you'd get about 75 gallons, and that's with a lot of fossil fuel input and a lot of deterioration of that soil. Seventy-five gallons of bio diesel. At that rate 5 percent, just 5 percent of our diesel fuel, or 5 percent of our heating fuel would take 30 million acres.

Just 5 percent of our diesel fuel. Well, there's only 300 million acres of arable land in the country today. I don't think we're going to take our food and turn it into fuel, especially as our system winds down and we need every bit of food we can get.

So another kind of delusion is that efficiency will save us. Well, there's wonderful things about efficiency. I certainly defer to my co-speaker here. Efficiency, we have to get every bit of reduction of usage that we can find. But in the long run many times better efficiency has led to more consumption. This is called Jevan's paradox. When we have better efficiency, the price goes down and people use more, and this is what's happened time and time again. So efficiency is a tiny step in the right direction. You can't argue with hybrids. They are more efficient, but they're just a tiny step.

In the long run we're going to run out, so what about the solutions? I'm going to jump ahead here to the solutions because that's what we really want to hear. And believe me, they're not very pretty or very easy. Again, be sure and get a book because this goes on and on and on.

First off, the number one solution, the metaphor I use is I'm sure many of you are familiar with the story of Ernest Shackleton and the Endurance. The Endurance just is going down and we desperately need leadership. There's not time for market forces or for individuals or whatever to – (applause) -- this is why it's so – it just was an incredible spark for us who are in this field and studying it to have this champion here, who is a voice in Washington. (Applause.) There may be hope yet.

But another – and Representative Bartlett doesn't know this, but just yesterday I was leaving the Common Ground Fair in Maine, our big fair, our big renewable, back-to-the-earth fair, whatever, and at that fair I was the keynote speaker Saturday. And I was leaving early yesterday in order to get a flight down here and Senator Kucinich was coming in and we kind of said hello. He has the book, by the way. The subject of his talk was sustainability.

In Maine we have different talks for different audiences. When I talk to the people of Maine, they know. They want to know what to do. They want to know the nuts and bolts and how to get off the grid and how big is your garden and so forth. But anyway, back to solutions. I tend to jump around here.

First off, we need the leadership. We need a Shackleton to guide us to Elephant Island and he never lost a man because when the ship's gone down and you've got to make it and you've just got so much provision to get from here to there, you can't have four people taking all the goodies and letting market forces or superior size or whatever taking the goodies and the other 16 or whatever – none of you are going to make it. The ship's going to go down. The life boat's going to go down. So we desperately, desperately – we never – civilization has never needed leadership as much as we need it right now.

Getting back to solutions. The next obvious thing, taking all this into perspective, taking all you said, the next obvious thing, if you know you're running out big time, Apollo 13 or the Shackleton's lifeboat or whatever, you ration, you conserve, conserve, conserve what you get, and my answer is rationing. And I remember well World War II, when we had the coupons. People say, well, rationing won't work. Well, I think rationing is infinitely better than letting market forces.

In Europe they let market forces take over and gas is $6 or $7 or $8 a gallon, and you know that the rich take it all and the poor ride their scooters. Now with rationing it doesn't work that badly. Everybody gets their coupons and the poor can do what they want with it, the rich can do what they want with it, but the demand, overall demand is depressed on a knowledgeable, definitive scale. So guess what? The price starts to go down. At least it doesn't go higher because the demand isn't there, and the poor can sell their coupons on the black market to the rich for 10 times as much. So what? (Laughter, applause) It works. It's human nature. And if you want to take a trip in your Winnebago, you can save up your coupons for two years and still do it. So my answer is conservation big time and rationing.

The second half of my book, the chance or the plan for sustainability, talks about all these issues. Three years ago I naively thought, well, we have 20 years to do this, if we took control of it now on a 5 percent per year basis, that we could pull this off and save so much fossil energy that would be distributed out over another 100 years and our kids could at least have a chance for a soft landing. I used to think that I was going to get out of this, it was going to be my kids' problem. Well, I don't think the way the numbers are turning up now that it's going to happen that long. We're looking at this year, two, three five. We're already seeing the problems right now.

I'm going to try to finish up here.

What to do. I come right back to the basic renewable energy sources, solar and wind. I've had a lot of fun. First off, as an engineer I try to look at this problem and say, is there any hope? Is there a modern civilization without any fossil energy? But knowing the technology we have today. And I'm a product design engineer and this is my challenge, and I think it could be done if we started now. It has to come from solar and wind. That's where the energy comes from, not from all these other things.

So I've been building – there's a picture in the back of my book of my solar-powered tractor and we can't go back to our ancestors with horses and oxen because we've got too many people. We've got too many mouths to feed. And a horse or oxen takes – you've got to feed it all winter. It takes four or five acres just to heat it – by the way, I'm a farmer, I grew up on a farm, and we have a 175-acre farm that we part-time farm now.

So the solar-powered tractor works. We take it to the fair and wow, I mean, it draws people in so we can talk about the demise of fossil energy. So I built a solar-powered car. Now I took a little golf cart, a 48-volt club car golf cart, put some panels on it, put a chiller battery system on it. I got 10 kilowatt hours of batteries in there. That thing will go 100 miles without recharging, but only at 15 miles an hour because that's – (laughter). But this sounds ludicrous, and you go out there, and I flew down here last night and drive up here and I call it petro-insanity. The more you see what's going on around the world, and the gridlock and driving these 4,000-pound personal vehicles, any other time in history, any other time in space they would look at us and say, this is totally absurd. And we grew up with it, we think it's here as part of our life. But it's just a pippin in civilization. Petro-insanity.

People ask me about the tractor. The tractor works, by the way. The tractor works big-time because when you need the tractor is in the summer, you've got tremendous amounts of sunlight coming in. And also the weight of the batteries is good. It works find. I took the tractor in a pulling contest in a fair a year ago, and the front end came up in the air, the thing just kept going, and I got a standing ovation. The people loved it. It really works, although it only worked an hour or two a day for 8 or 10 hours of refueling, but it's refueling all the time. The sunlight's coming in and it's even refueling while it's working. Even work horses don't do that.

I would say in summary, on a scale of 1 to 10, if 10 is this wonderful fossil energy we've gotten used to but is going out of style very quickly – not going out of style, going out of sight – and one is doing it by hand, one is doing it by hand, 10 by fossil energy, I would say that these solar-powered vehicles are maybe a 2 or a 3, 3 or 4. But it's better than walking. By the way, with my solar-powered vehicle, my solar-powered golf cart is a 2,500 watt portable generator, power supply. That's big-time power. In the wintertime you take these solar-powered vehicles, bring them right up to your house and run your house with them. So they work. Solar power, wind power. Get the book.

I can go on and on and on and on. You can't even begin to scratch the surface. But let me tell you again howe, h-o-w-e, at megalink.net. We talk about all these things. And thanks very much for coming, and good luck to Congressman Bartlett.

(Applause.)

REP. BARTLETT: Thank you turning in questions. There were two questions directed at me and I will include them together because they're the same subject. I understand you recently had a meeting with President Bush about peak oil. Is he aware of the potential consequences? If so, why aren't we serious about this from a policy standpoint.

And the second question is, how can we convince the administration and Congress that the recently passed energy bill was woefully inadequate and misdirected? I thought it was. I voted against it.

I did talk to President Bush. He does understand the problem. I tell you, this is a very good example of the tyranny of the urgent. The urgent always takes precedence over the important, and the urgent thing today, those couple of hurricanes down there and the urgent things tend to push important things off the table.

What we need to do is just for the American citizens. That's why we're here today. American citizens need to go to elected representatives, we have a problem, you need to do something about it.

Okay, and one for Matt Simmons. If the peak is going to be soon, five years or less, does it make sense to the U.S. to build more refineries?

We need to limit our answers to a couple of minutes or we're not going to get through our questions.

MR. SIMMONS: The simple answer is that our refinery system is so old today that if we don't replace it then – peak load doesn't mean running out, but if we don't replace it, we don't need any more oil. I mean, there's a refinery that got hurt in the hurricane, the Motiva (ph) refinery that they're talking about expanding a base unit that was built in 1903 to refine spindle top oil. We can't go 30 or 40 more years with 100-year-old refineries. So the answer is we've got to rebuild the refineries.

REP. BARTLETT: Thank you very much. And another one for Matt Simmons. Why is nuclear power not getting more attention in the U.S. as it is in Europe? Although the building of nuclear power plants may not mitigate the adverse effects of the oil crisis, it could provide long-term energy.

MR. SIMMONS: I was in a program at the University of Wyoming this weekend and I heard the most articulate speaker on nuclear – on the benefits of nuclear power. This is hard to see, but this is basically one nuclear uranium pellet. And this uranium pellet is the equivalent of a ton of coal. And one pellet – five pellets this size heat a home for a year. So we have got to go back to nuclear energy. It just takes a long time. And we can basically tackle the spent waste. That's a military problem.

But we also have to remember that nuclear power is electricity. We're going to have to have electricity because of our natural gas problem, but it doesn't solve the oil problem, period.

MR. SPEARS: Do we know what the supply lifetime of uranium is? Some estimates are as short as 50 years for uranium, at our current consumption rate.

MR. SIMMONS: This guy was actually part of a company in Saskatoon, Canada, our largest supplier. The reality is we don't have a clue, but we haven't explored for uranium for about 40 years.

REP. BARTLETT: I get widely divergent estimates of how much fissionable uranium is left in the world, from 30 years to 200 years. Before we can really have an effective dialogue about how to address this problem, we need to have an agreement on what the problem is. And there is just so much difference of opinion out there, and I talked to the National Academy of Sciences. They would be delighted.   We need to find the money for them. We need an honest broker somewhere that tells us roughly what the truth is because we have widely divergent opinions now as to how much fissionable uranium is out there.

MR. DEFFEYES: I suggest you look at the Scientific American for January 1980, Deffeyes and MacGregor, on the world uranium supply.

REP. BARTLETT: And how much is there, sir?

MR. DEFFEYES: Every time you drop the ore grade by a factor of 10, you find about 300 times as much uranium, so that going down to the ore grade of – going down through the ore grades continues to increase the supply. But just about the time we were writing that Scientific American article, these enormously rich deposits, and big deposits in Australia and Canada sort of blew away our early estimates and we had to quickly increase the estimates. There are deposits in Saskatchewan so rich that the miners can't be in the same room as the uranium, where the uranium is being mined. They mine it by remote control. So at the moment we're swimming in uranium, but the Deffeyes-MacGregor piece, which comes out with a Hubbard-like curve, says that, no, we can go on down, and specifically we don't need a breeder reactor.

REP. BARTLETT: If we don't need the breeder reactor, that's good news because if you had to go to the breeder reactor you would borrow some problems that you don't have with fissionable uranium.

MR. SPEARS: My concern is that the investment in nuclear power is huge, and we have a long history of massive investment in nuclear power. That same level of investment could also go towards completely safe renewable energy systems and technology development -- (applause) -- without the risks of nuclear power. And without the ultimate end of nuclear power, when the fissionable materials runs out, or we find that more Chernobyls and others have totally trumped that issue. (Applause.)

REP. BARTLETT: Thank you. We have a question here directed to Mr. Wulfinghoff, but it could have been asked of any of the panelists. If energy consumption obviously is related to the number of people who are here, and the questioner asked, why haven't any of you mentioned population? I would like to note that if you want to listen to what I think is the most interesting one-hour lecture I ever heard – and he's no relative, he has my name – Dr. Albert Bartlett from the University of Colorado gives a – how many of you have heard his lecture? He's given it 1,600 times, I think. He's pretty good at it by now. But he gives a lecture on the failure of the industrial society to understand the exponential function, and it's a lecture on energy.

You can find it—do a Google search for Hubbard's peak, or a Google search for peak oil and I think that you'll find Albert Bartlett there, and he give you a very good introduction to this and the population effect.

MR. DEFFEYES: What we don't want to hear about, one fellow said we've got 6 billion people, we're headed for 9, we're going to wind up with too many people and not enough food. His answer was cannibalism. (Laughter.)

MR. WULFINHOFF: Just to answer the question, I'm no more expert on that question than anyone else here, but I think everyone would agree, population is the big driver. And so yes, intelligent, responsible control of having kids is obviously a big part of the picture. I think that's a truism that we can all agree to.

MR. SPEARS: I'd like to get my two cents worth in. I don't think population control is a very tenable solution. However, education is, and if we have a population of educated people that understand and take full responsibility for their own needs in a society, which is completely technically possible if our society allows it to be, then we have a population that uses a very, very small fraction of the footprint of the planet that we currently use, and we could support a much higher population.

REP. BARTLETT: I believe that every industrialized country in the world, if it weren't for immigration, has a negative population growth now. That's true in the United States. Were it not for immigration – I think if it weren't for illegal immigration, our population would be declining in this country. And that's true of most of the industrialized world.

Is there another comment on this? John?

MR. HOWE: I think we should not get off this population issue too quickly because you keep peeling away at the layers of the onion, the energy, where we go from here, remember that, like Dick Heinberg said, the population grows with the resources. Since the beginning of this country we've had unlimited resources and we pat ourselves on the back saying how wonderful we are. But there are tremendous resources there. And then especially when the fossil energy came on.

So population has increased, like any biological species, and right now we are in such dire straits, and this is why I tend to be more pessimistic than just going over and sliding down Hubbard's curve because population wants to continue to go up, just like any biological species, at a time when resources are not only leveling off, they're going down. So we have this double whammy, this diversion between population and demand and resource capability. So this is going to open up pretty quickly, very quickly, and the population issue is incredibly important.

Let me go one step further. Even when there's a horizontal level, plateau of resources, life is not very friendly because Mother Nature always wants to produce more than the resources can stand, so there's always this chaos, the die-off or cruel short life, whatever you want to call it, and the males of the species try to go out and get their neighbors' stuff and the other males try to defend it so that it leads to a lot of chaos.

That's normal with any species. We see it with the mice in the barn. We call it the mice in the barn theory.

So we're reaching a double whammy. We're not only going to have horizontal population, we're going to go downhill in population, but we're going to go downhill in resources where population wants to continue to go up.

Now China's faced up to this problem for years and they've tried this one child per couple. It's been a very ugly situation in China. It has not worked very well. They've had midnight raids and abortions, and the women take the brunt of the problem. I'm going to go on record right here and you might want to throw me out, but I'm way out of my area. I don't know whether my area is as a philosopher or what. (Laughter) But rather than try and approach this the traditional way of the contraception or abortion or embryonic control or whatever, I think we should face up to the maleness of this issue. We're the trouble-makers. We're the ones that cause all the problems and don't want to admit it.

My solution to this, John Howe, Yankee solution, you heard this for the first time here, would be to one child – and this is the law of the land, by the way. Just like incest or murder or anything else. Every male. You have one child, you get a vasectomy, period. That's it. End of subject. (Applause.) It didn't hurt me a bit 20, 30 years ago. That's enough.

REP. BARTLETT: This next question deals with a subject that I had a question about. I called Mr. Simmons, he was gone, haven't had a chance to talk with him. So I'll now ask the question, along with the questioner from the audience. There was a recent article in one of the papers – was it the New York Times, the Washington Post? The Times, I think. About an experiment in Colorado where a plot of land 20 by 35 feet, and they got 1,500 barrels of oil from it, and I did some calculations that said there would be a hole in the ground 100 feet deep if that's true if they got that much oil out of that. They said they got 10 times as much out as if they mined it and cooked it on the surface. And that they put in one unit of energy, got out 3.5 units of energy. And if that's true, we're home free. What's wrong with this news story?

MR. SIMMONS: First, I think they're talking about the experiments that are going on in oil shale on the western –

REP. BARTLETT: That is correct.

MR. SIMMONS: And what it is is basically a return to a new concept that used to be called Project Rifle, which was effectively an experiment by Cosco (ph), which was the oil shale company, to bring a nuclear bomb into the oil shale and create an internal furnace there. What they're now doing is putting some electricity rods down. That's just very energy intensive, so they're ignoring the energy intensity to actually create a little bit of oil out of shale.

REP. BARTLETT: But they said in the article, at least the lady who wrote the article said that she was told that they put in one unit of energy and got out 3.5. They cooked it for two years, they froze all the ground around it to keep it from polluting ground water, and it was inconceivable to me that that could be energy-positive.

MR. SIMMONS: I just think those studies don't do a real honest energy count. And what we desperately need is a bureau of energy standards that take all the things that are required to make these things work and measure the energy. What they're doing is they're taking just one element. (Applause.)

REP. BARTLETT: Another one for Matt Simmons. Two-thirds of the oil that's still in the ground, why then are we not doing more to get it, and why are we not using renewable energy to power enhance oil recovery?

MR. SIMMONS: The whole two-thirds in the ground is an interesting concept because what's – that's probably a good number we think, but the third that's gone was the high quality useable oil. And what's left gets more and more energy intensive to be able to convert it into useable oil. I think one of the really terrible vocabulary words we created was tar sand, and we talk about it like it's useable oil. Tar sands are tar. They have to be melted by seam and then oozed out of the ground and then refined into heavy oil and then diluted with sweet oil to make synthetic crude.

Now it doesn't take rocket science to say that is really energy intensive. So we should call it coal. We shouldn't call it oil.

REP. BARTLETT: There are several other questions here that relate to some slides that I had for summing up, and maybe we'll go through those and answer those questions when it comes to that point in the slide. And we'd like the panel, too, and we'll just stop for comments as we run through this series of slides.

Okay, the next one. This one we've seen before. This is a typical bell-shaped curve, and the next one I think shows the break-out in this country. This was a very interesting one that shows where we've gotten our oil from from 1935 up until the present, and you see that we peaked in 1970 and one of the presenters noted the contribution of Prudhoe Bay, that's the Alaska oil there, and that was just a tiny blip in the slide down Hubbard's peak.

Now I'm opposed to drilling in ANWAR, not for environmental reasons (applause) –

MR. SIMMONS: Congressman, while you have that up, it's interesting basically, if you take the peak in 1970 and exclude the natural gas liquids in Alaska, and then you come down to where we are today, about 2 million barrels a day. About 40 percent of the two is our stripper wells, which are 2.2 barrels of oil a day. And we also strip out about 100 to 500 oils a day of brine.

My guess is that the energy used to pump the 500 barrels of brine is more energy than the 2.2 barrels. But luckily we have those stripper wells left or we'd be down to about 1 million barrels a day of conventional oil, excluding Alaska.

REP. BARTLETT: The reason I'm opposed to drilling in ANWAR is that Prudhoe Bay, which is much bigger than ANWAR will ever be, had very little effect on our downhill slide. I'm having a lot of trouble understanding, if we have only 2 percent of the known reserves of oil in the world, and use 25 percent of the world's oil, and import about two-thirds of what we use, I'm having a lot of trouble understanding how it's in our national security interest to use up the little bit of oil we've got as quickly as we can. (Applause.)

This may be a rainy day. I think there's going to be a rainier day.

Mr. Wulfinghoff, you have a comment.

MR. WULFINGHOFF: In the '70s they called that strength through exhaustion.

REP. BARTLETT: Notice the yellow up there. Remember the fabled Gulf of Mexico oil discoveries, and they were going to save the world? That's the contribution they made. That's the contribution they made.

The next slide, please. This is the schematic I showed before, and this is just a 2 percent growth here. Now you can make that Hubbard's peak as steep as you want by simply changing the abscissa and changing the scale on the ordinate. This is a 2 percent growth curve. It doubles in 35 years, so from where that use line separates, the demand line separates from the available line, that yellow consumes – that's 35 years because that's the doubling time with 2 percent growth.

So we're going to have problems of supply and dema nd – 17 years, it says, 17.5 years before we actually reach peak. So those who say peak is in the future, yes, peak will be in the future but we could still be having problems now. The next slide, please.

Okay, this is one I mentioned, and these numbers prompted Boyden Gray and McFarland and Jim Woolsey and a lot of retired four-star admirals and generals to write the president a letter saying, Mr. President, these numbers represent a totally unacceptable national security risk. We have got to do something about that.

Matt, you mentioned our pumping. We have only 2 percent of the world's reserves of oil, but we produce 8 percent of the world's oil from that. We're really very good at getting this oil out of the ground. What that means is that our 2 percent is going to run out more quickly, doesn't it? So we're going to face problems before others face problems. The next slide.

Okay, this is a really interesting one. The one at the bottom, by the way, is just a few years of the one above, and we separated out the gas and the oil. But this goes through – it begins back in the 1600's or something, I think. This looks at the industrial age, and first there's wood on the bottom, and that was stalling out and we found coal, and boy, we jumped with coal. Then we found oil, and look what happened. And if we were plotting the world's population, it would pretty much follow that oil curve. It has really been exploding.

When Malthus made his prediction that eventually population would outstrip our ability to provide food, we had less than a billion people. Now we're approaching 7 billion people. 5,000 years of recorded history. We're 100 years or so into the age of oil. In another 100 years or so we will be through the age of oil. What then?

By the way, we will transition to renewables. There is no question. There is no alternative. We will transition to renewables. The only question is how we do it, and the longer we wait, the longer we wait the more difficult the solution will be. The next chart.

This is a really interesting chart, and one of the presenters mentioned 86 percent – either 86 to 85 percent of all the energy we currently use comes from fossil fuels, and you see it up there in those three segments of natural gas, the petroleum and the coal. Of the 15 percent that is not fossil fuels, 8 percent of that is 20 percent of our electricity, 8 percent of our total energy comes from nuclear. That could grow. You need to determine whether the environmental penalties are worth the benefit you get from growing nuclear, but that certainly could and maybe should grow.

Now we've pulled out and expanded the renewable energy part of it there, which is 7 percent, and we've broken that down into 100 parts. Breaking that down into 100 parts solar is 1 percent of that 7 percent. That means it's .07 percent of our total energy production. Very attractive because it's non-polluting once you've made the cells. You could pollute while you're making them, but once it's in operation then it works. It really works.

Any by the way, it's kind of humbling. Two of those little 60-watt panels is all I'm worth in terms of energy, right? About 120 watts. You know, when the sun is shining, two of those panels put out more energy than I can put out – (audio break, tape change) -- geothermal is the one – that's true geothermal. That's tapping down into the hot core of the earth.

One of the presenters mentioned geothermal air conditioning and heating and so forth. That just wisely is coupling your heat pump – not to the air that you're trying to heat in the summertime and cool in the wintertime, which is really kind of stupid, isn't it – but it's coupling the heat and air conditioning to ground temperature where it's, here in Maryland, a constant 56 degree all year.

But true geothermal – and Iceland doesn't have a single chimney; it's all geothermal there, I think. We have some places in our country where you can get there.

Agriculture – about 0.14 percent – what this points out is that the sources that we're going to have to turn to in the future are now minuscule in terms of their contribution to our total energy supply. We have got a long way to go.

Conventional hydroelectric – that's almost half of all of these renewables. That's not going to grow much in our country. We've dammed up about everything we should have dammed up and maybe some things we shouldn't have, and we're breaching more dams now than we are making.

Wood – that's (not the ?) West Virginia hillbilly up there at 38 percent. That's the timber industry and the paper industry wisely using what would otherwise be a waste product to produce energy.

The 8 percent there from waste – that's one that really needs to grow. If you do down here to Dickerson, they have a plant down there that is burning municipal waste, and you know, I'd be happy to have my church next to it because it looks like an office building from the front of it, and they bring the trash in in containers. You never even see it until it's dumped into a big pit that the crane lifts it out of. I mean, we really shouldn't be burying this stuff; we should be getting some energy from it.

But this presents the enormous challenge we have. The energy sources that we will need to turn to as we wind down the age of oil now represent tiny, tiny contributions to our energy supply.

We must invest three things to get there. One of them we won't worry about: we won't worry about money; we'd never do that in Washington. (Laughter.) We have, by the way, the most unique credit card in the world in Washington. It's my voting card. It's a card without limit. I can change anything, any amount. There is no limit to how much I can charge. And it's really unique because I'm charging it to somebody else's account. I'm never going to pay that back. My generation is not going to pay it back. My kids and my grandkids are going to pay it back, so that's a really – that's a really unique card, isn't it?

We need to invest money, but we will borrow that from our kids and our grandkids. We won't worry about that in Washington. But the two things we can't borrow from you is time and energy, and that schematic curve that we showed a little bit ago, we can't even use all of that oil that's available to us for our ordinary economic activities or we'll have nothing to invest in these alternatives, so we have got to embark on a very aggressive conservation program so we have something to invest.

We had a hand up here for a comment? Yes, sir.

Q: What's really important in this discussion is how we and the policymakers and the public and the citizens frame the discussion. Historically we have framed the discussion about renewables and conventional energy as if renewables will always only be a small minuscule fraction of the mix, and in fact, almost all the energy experts you hear touting the future talk about new technologies in sort of conventional technologies: new oil, nuclear power, more conventional approaches being the biggest part of that pie, and renewables still only being a small fraction. Everybody says renewables will never be able to meet the demand of a growing industrial country.

That is absolutely false. Over and over we've proven, every single day, that you can provide 100 percent of the demand of an industrialized country with 100 percent renewables, and unless we start the discussion where that's the goal – which inevitably, as you said, it will ultimately become that because everything else is going to run out – unless we start framing the discussion around that notion, we'll never get there. We'll only incrementally reduce our dependence on fossil fuels and never really give the focus on transitioning to a 100-percent-renewable economy that it needs to make it happen.

(Applause.)

REP. BARTLETT: A generation – thank you – a generation ago there was a scientist – C.P. Snow I think his name was – who made a statement that I wonder if you agree or disagree with. He says be optimistic about all of the alternatives – how much energy to get from them – add them all up, and you still come way short of both the quantity and quality of energy we're getting from fossil fuels. That's true?

MR. SPEARS: I don't deny that. One of the things I think we should all take a quick look at – that study I showed, "Energy-Rich Japan" is at energyrichjapan.org, or if you just Google energy rich Japan, you can get that study; it's available free on the Internet. And it shows what technology can do in an industrialized country.

I know what I can do with somebody's house or somebody's community. I can make that completely self-sufficient. I can't imagine why we can't build communities that are completely self-sufficient.

We're never going to run Hummers on renewable energy, and that's the fallacy, and we have to have deep, deep efficiency improvements. Efficiency is energy. It's the fastest developing energy supply we can have. If we want to immediately reduce our dependence on foreign oil, all we have to do is improve the efficiency of our existing infrastructure, and we can do it real quickly.

REP. BARTLETT: Yes, the cheapest oil you use is the oil you don't buy, isn't it – that you don't need to use because you've conserved.

The next chart, please. Okay, the upper one shows a controversy that's going on. I spent, about three weeks ago, a full day in Washington at the National Press Club. Dr. Pimental was there and his colleague from the West Coast, and they contend that more energy goes into producing ethanol – more fossil fuel energy goes into producing than you'll get from it. I hope they're not correct.

What I have up here is the data from the Department of Energy, which I am told by the experts is wildly optimistic, and on the left you will see that they believe that you can get a million BTUs with an input of about 750,000 BTUs from fossil fuel. But at the bottom is the one that I want to spend a couple of moments looking at because that's a really interesting one.

This is the energy that goes into producing a bushel of corn. On the right over there, that purple one – almost half of the circle – is the energy from natural gas to produce nitrogen fertilizer. Before we learned how to do that, the only nitrogen fertilizers available for agriculture were barnyard manures and guano. Guano was the droppings of tropical birds and bats for hundreds of thousands of years, and we have an industry, ships going around the world.

The last time I was in Grand Canyon, there was still a rusty cable there for a cable car that went into a bat cave in the wall of the Grand Canyon to bring out guano. Without fossil fuels, we can't have nitrogen fertilizers in the quantity we have them today, and it's very energy intensive. Almost half of all the energy that goes into a bushel of corn comes from natural gas producing the nitrogen fertilizer.

By the way, you may have wondered why, if you water your lawn, it's never quite as green as after a thunderstorm, and that's because you get more than just water from a thunderstorm. We get what we call poor man's fertilizer because the lightening now combines nitrogen in a form that's carried down by the water into the soil and can be used by the plants. And we have learned to do that now with enormous energy.

Look at almost every other segment of that pie there, and it's fossil fuel energy. The production of these crops is very, very energy dependent.

The next slide. This is one that we've been talking about all day: potential alternative solutions, and we'll just start down those.

The tar sands and the oil shales – there's an incredible amount of oil there, but whether or not it is recoverable, both economically and energy-wise is debatable. The Canadians are now getting oil from their – what do they call them? Oil sands they call them, I think, there. They're getting it at about $30 a barrel. But I'm told that they're using more energy from natural gas – by the way, they're producing it at $30 a barrel so they make a big profit selling it at 65 (dollars), but I'm told that they are using more natural gas energy to produce the oil than you will get out of the oil. That's called energy profit ratio. Not only is there a dollar-and-cents profit ratio, there's an energy profit ratio you have to think of in these things. So although there's a great deal there, it's not going to be very energy positive if in fact it is energy positive, and you're going to pay a big environmental penalty because of all the energy you have to use to get some little net energy.

Coal – 250-year supply in our country. Many people will tell you not to worry; coal will take care of us. There is 250 year supply at current use rate, but if you increase the use of coal just 2 percent, compounded – which Albert Einstein says, by the way, is the most powerful force in the universe, the force of compound interest – if you have a 2-percent growth compounded, it shrinks from 250 years to 85 years, and then if you allow that you can't put coal in the trunk of your car, you're going to have to convert it to a gas or a liquid, you now use some energy to do that, so now you're down to 50 years. With a – either a big environmental penalty using that coal because all the coal that's in our country now is pretty dirty stuff with a lot of sulfur in it, or a big energy penalty in taking the pollutants out of the coal.

We talked about nuclear, and if in fact there is an essentially unlimited amount of fissionable uranium and you are willing to accept the environmental impacts of that, we could be producing – France is now -- what, 70, 80 percent of their electricity is produced by nuclear, and so that's something we really need to think about.

Nuclear fusion, by the way – I support all the money. About 300 million (dollars) a year goes into that. You know, I think our chances of getting nuclear fusion are about the same as my odds of solving my personal financial problems by winning the lottery. (Laughter.) Now if you think that's a good bet, well, you may think that nuclear fusion is a good bet. That doesn't mean we shouldn't try, and I support all the money that that sector of our technology can support.

Then we get down to the true renewables: solar and wind and they are now 0.07 percent each. They can grow, but it's going to take a big investment of time and energy, building the factories, making the solar panels, making the wind machines.

I've heard the wind machines make a lot of noise. My wife and I were coming back from West Virginia. We came by Thomas – Davis, West Virginia, where they have a whole string of them there. We pulled off of the road. I didn't need to turn off my engine – I'm in a Prius; when you stop, it stops – opened the windows. I didn't hear anything. These were the great, great, big machines out there. People don't think they're pretty. I don't think these scars through our forests – running these power lines through – are very pretty either, but somehow we've learned to live with those. To get to any meaningful amount of energy from solar and wind, we're going to have to make big, big investments of time and energy to get there.

Geothermal – where it's available, we really ought to be exploiting that. That's essentially forever. Once you get there it will just work and work and work.

Ocean energy – can you imagine how much energy it takes to lift the oceans two feet? That's what the tides do, that's what the moon does with the tides, but because it is so diffuse, we have a hard time harnessing that energy.

I used to be very optimistic about energy from agriculture, but I'll tell you, tonight a fifth of the world will go to be hungry. Our topsoils are not increasing in either quantity or quality; as a matter of fact, until we learned to no till, they were decreasing in both quantity and quality. So I have some concern about how much biomass we can take from our agricultural lands and still have good agricultural land. There's probably something, but I'm not sure it's all as much as we had thought before.

The soy, diesel, biodiesel, ethanol, methanol, biomass – waste energy that we really should be doing. We really should be doing that.

Hydrogen – we talked a lot about that. Hydrogen is not an energy source. Hydrogen is simply a convenient way of transporting energy when you finally use it. By the way, the battery in your car is totally non-polluting when you finally take the energy out of it, isn't it, and hydrogen is the same way. I mean, you get water out of it, which is pretty non-polluting. But you may have polluted when you make the hydrogen.

We have three experts down in Washington, and we're talking about the hydrogen economy in the future, and they all agreed that only one technology would get us there. Three ways to store hydrogen: one is to put it under pressure – the lightest element that we have; always wanting to expand and get out; big, thick vessels, very heavy. The second was to liquefy it; very, very cold; lots of insulation, lots of energy and liquefying it. And the third was the one that they thought would work, and that was some chemical combination – reversible chemical combination. That's a hydrogen battery.

I don't know if inherently the hydrogen battery is going to be that much better than the electron battery which we have today, but a lot of people believe that hydrogen is an energy source and it's the solution to our energy problems, and if we get there we're home free. We just aren't home free because you've got to make the hydrogen. You'll always use more energy making it than you get out of it. It's still a good idea, by the way, because it is transportable. Use it in a fuel cell where you have twice the efficiency of the reciprocating engine.

Is there a last slide? Oh, the last slide is the challenge we have, and we now need to make – if we're going to have anywhere close to a soft landing, we have now got to be making some decisions equivalent to the kind of decisions they made in Apollo 13, so that – you know, they had a fairly narrow window, and if they'd hit that window, it was disaster.

Now we have a really rough ride – it's not a perfect analogy because we will get there; we will get to renewables. It's a question of how rough the ride is going to be.

Well, any comments or questions from our panel before we thank everybody for coming and thank our panel for their contributions?

MR.   : Thank you.

REP. BARTLETT: Mr. Wulfinghoff?

MR. WULFINGHOFF: Yes, one of the points I didn't get to make because I was running overtime is that the single most important thing that we have to do right now to make this happen is to get the word out, and I want to thank you and your staff for doing that. You are doing the critical thing that we need to survive.

(Applause.)

REP. BARTLETT: Thank you. Thank you.

The questions we didn't get to – we'll try to answer those by mail. Just call our office – any of our offices and we'll be responsive to your questions. And we won't know the answers, perhaps, but we'll get them from the panel.

I want to thank the panel very, very much. I'm really honored they'd come. They've come from all over the country, they are the world's experts in this area. Thank you all very much for coming.

Audience, thank you for your participation. Thank you very much. (Applause.)

(END)